Vol. 34 No. 2

BULLETIN

OF THE

TORREY BOTANICAL CLUB

FEBRUARY, 1907

Two new species of Aytonia from Jamaica

CAROLINE COVENTRY HAYNES[1]

(WITH PLATES 5 AND 6)

Aytonia Evansii sp. nov.

Thallus light-green, with a narrow purple margin, plane, ovate to linear-oblong, lingulate, 10–14 mm. × 4–7 mm., innovating from apex or laterally from costa, or dichotomous; margins of thallus elevated, undulate, crisped; width of thallus in cross-section eight times that of maximum height; the epidermal cells somewhat quadrate with distinct trigones, cuticle finely granulate; the stomata small, not elevated above thallus, 4 or 5 cells around the pore in 1 or 2 concentric series; ventral scales vinous-purple, imbricated, scarcely decurrent, lunate or obliquely ovate, reaching beyond thallus and reflexed only at notched apex, well-developed and persistent, however, from base of thallus to apex, tapering gradually to a long lanceolate occasionally geminate point, margins entire: oil-bodies completely filling isolated cells occurring generally through the thallus excepting in epidermal layer: monoicous: ♀ receptacles usually several in a series: androecium situated directly behind ♀ receptacle, furcate, surrounded with purple lanceolate or linear paleae 2–7 cells in maximum width: peduncle 5 mm. long: carpocephalum 2–3-lobed, generally maturing two opposite sporogonia, concave at apex, scales of the carpocephalum lanceolate or linear-lanceolate, 5–12 cells in maximum width, nearly hyaline: spores averaging 87 μ, yellow or brownish, enveloped in a very loose reticulate-rugose exospore: elaters 2–4-spiral, attenuate at ends 223–306 μ in length, 13 μ in maximum width. (PLATE 5.)

The above description has been drawn from material collected on banks, near Portland Gap, Blue Mountains, Jamaica, July 21, 1903, *A. W. Evans 213*.

[The BULLETIN for January 1907 (34: 1–56, *pl. 1–4*) was issued 27 F 1907.]

Plagiochasma elongatum Lindenb. & G., from Mexico, known to the writer only through descriptions, appears to resemble the Jamaican plant but the latter differs in possessing a shorter and broader frond which is 10–14 mm. long while that of *P. elongatum* reaches 35 mm.; *P. elongatum* has only 2–3 cells around pore, the Jamaican plant 4–5 cells; the ventral scales of *Aytonia Evansii* taper gradually, while those of *Plagiochasma elongatum* are described by Stephani * as abruptly attenuate to the appendiculum.

Aytonia jamaicensis sp. nov.

Thallus light-green with a narrow purple margin, somewhat plane or broadly canaliculate, ovate to linear-oblong, 5–18 mm. × 5–6 mm., innovating from the apex and from the side of the costa; margins of thallus elevated undulate-crenulate and slightly crisped; width of thallus in cross-section six times that of maximum height; the epidermal cells generally quadrate, showing small trigones; the stomata large, elevated, with 5–8 cells around the pore in 2–4 concentric series: ventral scales vinous-purple, strongly decurrent and approximate in the median ventral line, imbricated, broadly lunate or ovate, projecting beyond margin of thallus only at notched apex, reflexed over the growing point; appendicula ovate-lanceolate, occasionally geminate, strongly constricted, 7–12 cells in maximum width, with a uniseriate apiculum of 1–3 cells in length, margins subentire, undulate-crenate or sparingly toothed: oil-bodies completely filling isolated cells in the colorless stratum of thallus: monoicous: ♀ receptacles usually several in a series on an apical innovation in front of androecium: scales of androecium deltoid or cuneate-ovate: peduncle 11–16 mm. long: carpocephalum 2–4-lobed, generally maturing two opposite sporogonia and then concave or transversely furrowed above or sometimes slightly convex; scales of the carpocephalum lanceolate or linear-lanceolate, 5–14 cells in greatest width, often acuminate with a constriction near the apex: spores averaging 85 μ, yellow or brownish, enveloped in a very loose reticulate-rugose exospore, this easily detachable, spore after removal of exospore averaging 46 μ: elaters 2–3-spiral, occasionally forked, somewhat attenuate at ends, 255–374 μ long, 8 μ in maximum width. (PLATE 6.)

The above description has been drawn from material collected at Chestervale, Jamaica, February, 1903, *L. M. Underwood 1173* (type) and *1177* [both mixed with *Reboulia hemisphaerica*].

* FRANZ STEPHANI. Species Hepaticarum. Bulletin de l'Herbier Boissier **6**: 785. 1898.

The species is related to *Plagiochasma Wrightii* Sulliv., which shows the following differing characteristics: stomata not so much elevated, the 5–8 cells around the pore being in 2 or 3 concentric series; appendicula not so much constricted, narrower, margins always entire; peduncle shorter, 2–4 mm. (?); scales of the carpocephalum never constricted; spore distinctly tetrahedral and winged, exospore not so loose. Type duplicate of *P. Wrightii* from Texas in Herbarium Underwood shows 5–8 cells around pore instead of 6 cells as given by Herr Stephani in his *Species Hepaticarum*.

These two Jamaican species differ from each other in shape and size of stomata, form of ventral scales and their appendicula, the position of androecium and in the character of the cuticle.

The above work was done under the supervision of Dr. Marshall A. Howe to whom I am deeply grateful. Thanks are also due Professors Underwood and Evans for allowing me to study their material.

NEW YORK BOTANICAL GARDEN.

Explanation of plates 5 and 6

PLATE 5. *Aytonia Evansii* sp. nov.

1 and 2. Plant, natural size.
3. Outline of cross-section of thallus, × 9.
4. Median cross-section of thallus showing stomata, × 55.
5. Stoma, × 242.
6. Plant, showing two immature carpocephala and androecium, × 6.
7. Plant, showing nearly mature carpocephalum, with peduncle 4 mm. long, and androecium, × 6.
8 and 9. Ventral scales, × 13.
10. Ventral scale showing geminate appendicula, × 13.
11–13. Scales from the carpocephalum, × 13.
14. Scale from the carpocephalum showing cells, × 55.
15. Surface view of stoma; epidermal cells and trigones, × 360.
16. Spore, inner face, × 250.
17. Spore, outer face, × 250.
18. Spore, optical section, × 242.
19. Elater, 3-spiral, × 175.
20. Elater, 2-spiral, × 175.
21. Oil-body completely filling cell, × 250.
22. Scale from androecium, × 55.

PLATE 6. *Aytonia jamaicensis* sp. nov.

1. Plant, natural size.

2 and 3. Outlines of cross-sections of thallus, × 9.

4. Median cross-section of thallus showing stoma, × 55. The fungal hyphae shown here in certain cells were found inalmost all specimens examined and occur generally through the ventral portions of the thallus.

5. Stoma, × 242.

6 and 7. Upper and lower sides of a single immature carpocephalum, × 6.

8 and 9. Opposite sides of a single carpocephalum with two mature sporogonia, no. 8 showing upper portion of peduncle, × 6.

10 and 11. Opposite sides of a single carpocephalum showing the mature sporogonia, a third abortive one, and upper portion of peduncle, × 6.

12. Ventral scale showing geminate appendicula, × 17.

13. Ventral scale showing single appendiculum, × 17.

14–17. Scales from the carpocephalum, × 13.

18 and 19. Scales from the carpocephalum showing cells, × 55.

20. Surface view of stoma, × 360.

21. Surface view of epidermal cell and trigones, × 250.

22. Spore, inner face, × 250.

23. Spore, outer face, × 250.

24. Spore, optical section, × 242.

25. Elater, 2-spiral, × 182.

26. Elater, 3-spiral, × 175.

27. Oil-body completely filling cell, × 250.

28. Scale from androecium, × 55.

Studies in North American PeronosPorales — I. The genus Albugo

GUY WEST WILSON

The North American species of *Peronosporales* offer a rich field for investigation. Containing as this order does some of the worst fungous pests of the farm and garden, extensive studies of certain species were undertaken at an early date in our mycological history, yet our present knowledge of the group is very fragmentary. The greater part of the printed information concerning it consists of notes on various species scattered through articles of a general mycological nature. Some species have been made the subject of independent articles, while few papers deal with a considerable number of species. Only two of these are comprehensive in scope. One is a series of notes by Swingle * upon the specimens in the herbarium of the Division of Vegetable Pathology, the other is Dr. Farlow's monograph,† which includes thirty-eight species and requires less than an octavo page for a complete host index. Since then the number of species credited to North America has almost doubled and the list of hosts increased many fold.

The genus *Albugo* constitutes the family *Albuginaceae*, the species of which bear a superficial resemblance to the *Uredinales*, from which they are readily distinguished by the light color and glistening appearance of the sorus and by the unsculptured conidia which are borne in chains. More marked points of difference, but not so readily observed, are the germination of all spores by zoöspores instead of by germ-tubes, and the production of sexual oöspores.

The oöspores of all the North American species have been studied, in the preparation of the present paper. Upon the basis of oöspore-characters the species fall into two well-defined groups. The first of these includes the North American *A. candida*, *A. Ipomoeae-panduranae* and *A. Lepigoni*, and the foreign *A. sibirica* and *A. tropica*. This group is characterized by having the epispore of the

* Jour. Myc. 7 : 109–130. 1892.

† Bot. Gaz. 8 : 306–325, 327–337 ; 9 : 37–40. 1883–84.

oöspore tuberculate or ridged. According to the investigations of Zalewski * and Stevens † this is the more specialized group. The former author points out the more complex character and apparently more complete development of the epispore, while the latter deals with cytological phenomena only. The second group of species is characterized by a reticulate epispore and contains the remaining species of which the oöspores are known, and in all probability the two species in which they are at present unknown. There are three or four well-defined types of reticulation represented, all of which are found among the American species. The first of these is represented by *A. Bliti* and *A. platensis* and may be considered typical of this group. The reticulations are very evident, the meshes large and the areolae deep and unoccupied by any elevations. The pattern is often somewhat imperfectly developed. From this type the other species vary in a striking manner, yet the primary characters remain the same. In *A. Tragopogonis* and *A. Swertiae* the areolae are not so deep and the reticulations are crested at their angles with more or less prominent tubercles. In *A. Portulacae* the variation takes the form of tubercles within the areolae while the reticulations themselves are similar to those of *A. Bliti*. Unique within the genus is *A. occidentalis*, which has the epispore finely reticulate and the areolae so shallow as to give the impression, at first sight, of pits rather than reticulations. The conidia are quite similar to those of *A. tropica*, but the oöspore-characters indicate a closer relationship to *A. platensis* or *A. Swertiae*. According to Zalewski the reticulate spores have a less perfectly developed epispore which reaches its highest development in *A. Tragopogonis*. This arrangement of species is confirmed by the work of Stevens.

The material upon which the present paper is based is contained in the herbaria of the New York Botanical Garden and of Columbia University and in the private collections of Dr. L. M. Underwood, Dr. J. C. Arthur and the author. The literature of the genus has been carefully looked over by means of Dr. Farlow's Bibliographical Index and other aids. No localities are cited from which material has not been examined, but all published

* Bot. Cent. 15: 215–224. 1883.

† Bot. Gaz. 32: 77–98, 157–169, 238–261. *pl. 1–4 + text figs.* 1901.

reports have been taken into account in determining the distribution of species; and mention is made of all reported hosts upon which no specimens have been seen. The determinations of all hosts have been verified, with the resulting omission of a few of those previously published. These discrepancies are noted in the proper places by the insertion after the specimen of the previously published host name. All specimens containing oōspores are marked by an asterisk (*). Inasmuch as the hosts, or species closely related to the hosts, of all the extralimital species of the genus occur in North America, these species have been included in the key, and brief mention made of them in their place in the sequence of species. In conclusion I wish to express my appreciation of the courtesies which have been shown me in this work by the loan of specimens, by critical suggestions and by the determination of hosts.

ALBUGO (Pers.) S. F. Gray, Nat. Arr. Brit. Pl. 1: 540. 1821

Uredo § *Albugo* Pers. Syn. Meth. Fung. 223. 1801.
Cystopus Lév. Ann. Sci. Nat. III. 8: 371. 1847.

Conidiophores simple, cylindric or clavate, crowded into subepidermal sori without peridium or paraphyses; conidia cylindric or globular, borne in chains, smooth, hyaline or with light-yellow contents; oōspores globular, produced in various parts of the host, often separate from the conidia and forming more or less conspicuous masses; spores liberated by the rupture of the epidermis of the host; germination always by zoōspores.

Type species, *A. Cruciferarum* S. F. Gray = *Uredo candida* Pers.

Key to the species

Oōspore tuberculate; conidia globose or more or less cylindric, not as long as broad, if discoid the membrane of equal thickness throughout.
Oōspore with prominent tubercles; conidia similar, or the terminal smaller.
Oōspore with a few very large tubercles; conidial membrane of equal thickness throughout.
Conidia globular, hyaline.
Conidia and oōspores large; hosts Papaverales, mainly Brassicaceae. 1. *A. candida.*
Conidia and oōspores small; hosts Boraginaceae. 2. *A. sibirica.*
Conidia discoid, yellow. 3. *A. tropica.*

Oōspore with numerous small tubercles; conidial membrane with an equatorial thickening. 4. *A. Ipomoeae-panduranae.*

Oōspore finely echinulate; conidia dissimilar, the terminal larger. 5. *A. Lepigoni.*

Oōspore reticulate (unknown in nos. 8 and 9); conidia cylindric or elliptic, usually longer than broad, if discoid the membrane with an equatorial thickening.

Oōspore with the areolae unoccupied; conidial membrane with an equatorial thickening.

Oōspore coarsely reticulate; conidia elongate.

Oōspore with the reticulations tuberculate at their angles; conidia cylindric, or with more or less rounded corners, hyaline, the terminal larger.

Conidial membrane always with an equatorial thickening.

Conidia more or less rounded; hosts Gentianaceae. 6. *A. Swertiae.*

Conidia cylindric; hosts Compositae. 7. *A. Tragopogonis.*

Conidial membrane of the terminal conidjum only with an equatorial thickening. 8. *A. quadrata.*

Oōspore without tubercles; conidia obovoid or elliptic.

Conidia obovoid, the terminal larger. 9. *A. Tillaeae.*

Conidia elliptic, the terminal smaller.

Conidia uniformly hyaline. 10. *A. Bliti.*

Conidia light-yellow, the terminal with a dark equatorial band. 11. *A. platensis.*

Oōspore finely and shallowly reticulate, appearing pitted; conidia discoid, yellow. 12. *A. occidentalis.*

Cōspore with a tubercle in each areola; conidia cylindric, the membrane of uniform thickness. 13. *A. Portulacae.*

1. ALBUGO CANDIDA (Pers.) Kuntze, Rev. Gen. Pl. 2: 658. 1891

Aecidium candidum Pers. in Gmelin, Syst. Nat. 2^2: 1473. 1791.
Uredo candida Pers. Syn. Meth. Fung. 223. 1801.
Uredo Cheiranthi Pers. Syn. Meth. Fung. 224. 1801.
Cystopus candidus Lév.; Berk. Jour. Hort. Soc. London 3: 271. 1848.

Sori on all parts of the host except the roots, white or rarely light-yellow, prominent and rather deep-seated in the tissues of the host, very variable in size and shape, often confluent and frequently producing marked distortion of the host; conidiophores hyaline, clavate, about 35–40 × 15–17 μ; conidia similar, globular, hyaline, with uniform thin walls, 15–18 μ; oōspores usually confined to the stems and fruits of the host, rarely in the leaves, chocolate-colored,

about 40–55 μ; epispore thick, verrucose, or with low blunt ridges which are often confluent and irregularly branched.

This is the most widely distributed and by far the commonest species of the genus. Occurring as it does upon such a large number of hosts, a wide variation in characters is to be expected, yet an examination of numerous specimens, both American and foreign, has shown a remarkable stability of essential characters. The fungus as it grows upon *Bursa*, from which it was originally described, does not differ materially, either in habit or measurements, from that upon other species of *Brassicaceae*. In Europe the same fungus attacks various species of *Capparidaceae* and exhibits the same characters. An *Albugo* which occurs in Europe upon *Reseda* has also been referred to this species, from which it differs materially in habit, producing a much thinner and more superficial sorus than those produced upon the other two families of hosts. In the absence of oöspores and of perceptible difference in the conidia this disposition of the material had best be retained. The point of greatest variation in the species in America is that of oöspore-formation. The oöspores have not been observed on the majority of hosts and their location varies greatly in cases where they are known. Oöspores have been examined from the following hosts: *Brassica nigra* (stems), *Bursa Bursa-pastoris* (capsules), *Camelina microcarpa* (leaves), *Raphanus sativus* (capsules), *Roripa Armoracia* (leaves) and *Sophia pinnata* (leaves). Swingle * also reports oöspores from *Dentaria diphylla* (leaves), *Bursa Bursa-pastoris* (stems) and *Lepidium campestre* (stems). The morphology of this species has been studied by Wager † and Stevens. ‡

ON BRASSICACEAE:

Arabis furcata S. Wats., Montana, *Rydberg & Bessey 4230;* Washington, *Suksdorf 266.*

Arabis lyrata L., New York, *Underwood.*

Arabis virginica (L.) Trel., Alabama, *Underwood;* Mississippi, *Tracy.*

Barbarea Barbarea (L.) MacM., California, *Heller 5108* (Fungi Columb. *1710*).

---

* Jour. Myc. 7: 110, 111. 1892.

† Ann. Bot. 10: 297–342. *pl. 15, 16.* 1896.

‡ Bot. Gaz. 32: 91, 98, 254. *pl. 2.* 1901.

Brassica arvensis (L.) B. S. P., South Dakota, *Chaney.*

Brassica campestris L., Massachussetts, *Humphrey* (Econ. Fungi *401*).

Brassica integrifolia (West.) O. E. Schultz, St. Croix, *Ricksecker 336.*

Brassica nigra (L.) Koch, Alabama, *Carver;* Illinois, *Burrill;* Indiana, *Olive;* Iowa, *Arthur;* Nebraska, *Williams;* New Jersey,* *Halsted* (Econ. Fungi *256*); South Dakota, *Griffiths* (W. Am. Fungi *46*).

Brassica sp., Wisconsin, *Pammel.*

Bursa Bursa-pastoris (L.) Britton, California, *Copeland;* Illinois, *Earle, Seymour;* Indiana, *Underwood 3734* (Ind. Fl. *98a*), * *Wilson;* Iowa, *Macbride;* Kansas, *Baker* (Fungi Columb. *2108*); Massachusetts, *Farlow* (N. Am. Fungi *204a*); Michigan, *Beal* (Econ. Fungi *257b*); Missouri, *Galloway, Galloway & Tracy, Trelease;* New Jersey, *Halsted* (Econ. Fungi *257a*), *Stevens;* New York, *Arthur, Britton, Underwood, Underwood & Cook* (Illust. Fungi *91*); Ohio, *Kellerman* (Ohio Fungi *122*); Ontario, *Dearness* (Fungi Columb. *133*); Wisconsin, *Pammel.*

Camelina microcarpa Andrz., Ohio, **Tyler* (Ohio Fungi *63*, on "*C. sativa* (L.) Crantz"); Virginia, *Murrill.*

Cardamine bulbosa (Schreb.) B. S. P., Indiana, *Olive.*

Cheiranthus asper Nutt., Oregon, *Suksdorf 220.*

Cheiranthus pacificum Sheldon, Oregon, *Sheldon.*

Dentaria diphylla Michx., New York, *Shear* (N. Y. Fungi *199*), *Underwood.*

Dentaria laciniata Muhl., South Carolina, *Rolfs 1687.*

Hesperis matronalis L., Ontario, *Dearness.*

Iodanthus pinnatifidus (Michx.) Steud., Indiana, *Arthur.*

Lepidium densiflorum Schrad., Nevada, *Baker 1087.*

Lepidium virginicum L., Florida, *Hume 34;* Illinois, *Earle;* Indiana, *Arthur, Underwood;* Kansas, *Bartholomew* (Fungi Columb. *2110*); Nebraska, *Williams;* New York, *Underwood;* Mississippi, *Tracy;* South Carolina, *Ravenel* (Fungi Car. **4**: *93*), *Rolfs 1661;* Texas, *Ravenel 291a;* Bahama Is., *Hitchcock* (on "*Cakile maritima* Scop.?"); Bermuda, *Brown & Britton.*

Neslia paniculata Desv., Quebec, *Eggleston 2978*.

Raphanus sativus L., Illinois, *Breyfogle;* Indiana, *Underwood;* Iowa, *Arthur;* Kansas, **Bartholomew* (Fungi Columb. *1805*); New York, *Arthur*, **Underwood*.

Roripa Armoracia (L.) A. S. Hitchcock, Indiana, *Stewart*, * *Wilson;* Kansas, *Bartholomew* (Fungi Columb. *1806*), *Kellerman;* Massachussetts, *Seymour* (Econ. Fungi *454b*); Missouri, *Demetrio* (N. Am. Fungi *2420*); New Jersey, *Stevens;* New York, *Arthur, Holzworth, Underwood;* Ohio, *Kelsey* (Econ. Fungi *454a*); South Dakota, *Williams*.

Roripa hispida (Desv.) Britton, Illinois, *Arthur*.

Roripa obtusa (Nutt.) Britton, Kansas, *Bartholomew* (Fungi Columb. *2109*).

Roripa palustris (DC.) Bessey, Oregon, *Cusick 2600*.

Roripa sessiliflora (Nutt.) A. S. Hitchcock, Illinois, *Patterson;* Iowa, *Ehinger;* Kansas, *Bartholomew* (Fungi Columb. *2001*); Kentucky, *Price;* Tennessee, *Ruth 747*.

Roripa Walteri (Ell.) Greene, Florida, *Underwood;* Texas, *Bush 25, Lighthipe*.

Schoenocrambe linifolium (Nutt.) Greene, British Columbia, *? Macoun*.

Sisymbrium officinale (L). Scop., Indiana, *Arthur, Olive, Underwood, Wilson;* Massachusetts, *Farlow* (N. Am. Fungi *204b*); Missouri, *Bartholomew* (Fungi Columb. *2111*); New Jersey, *Halsted* (Ec. Fungi *259a*); New York, *Underwood 270a;* Nova Scotia, *Robinson 463a;* Ontario, *Dearness* (Econ. Fungi *259b*); Pennsylvania, *Britton;* Washington, *Parker, Piper;* Wisconsin, *Pammel*.

Sophia Hartwegiana (Tourn.) Greene, Montana, *Anderson, Kelsey*.

Sophia incisa (Engelm.) Greene, Colorado, *Baker, Earle & Tracy 1084;* Montana, *Kelsey*.

Sophia millefolia Rydb., Indiana, *Underwood*.

Sophia pinnata (Walt.) Britton, Arizona, * *Griffiths* (W. Am. Fungi *335*); Indiana, *Underwood* (Ind. Fl. *98b*); Durango, *Palmer*.

Thlaspi glaucum A. Nelson, Wyoming, *Nelson 4177*.

Thlaspi Nuttallii Rydb., Montana, *Blankinship*.

Brassicaceae sp., Montana, *Anderson.*

The following additional hosts are reported within our limits: *Arabis glabra* (L.) Bernh., *Brassica Napus* L., *B. oleracea* L., *Cakile edentula* (Bigel.) Hook., *Cheiranthus* sp. cult., *Coronopus* sp., *Draba caroliniana* Walt., *Lepidium campestre* (L.) R. Br., *L. sativum* L., *Roripa Nasturtium* (L.) A. S. Hitchcock, and *Sinapis alba* L.

TYPE LOCALITY: Europe, on *Thlaspi Bursa-pastoris* L. = *Bursa Bursa-pastoris* (L.) Britton.

DISTRIBUTION: Southern Canada to Mexico, Bermuda, and the West Indies. Also in South America, Europe, Asia, Africa, Australia, and New Zealand.

2. **Albugo sibirica** (Zalew.)

Cystopus sibiricus Zalew. Bot. Cent. **15**: 222. 1883.

No material of this species has been examined. It is known only from the original description, where it is recorded from some species of *Boraginaceae* from Siberia erroneously referred by Baron von Thümen to *Echinospermum Lappula.* It is said to differ from *A. candida* in its smaller measurements and in the structure of the epispore of the oöspore.

3. **Albugo tropica** (Lagerh.) Lagerh. ined.

Cystopus tropicus Lagerh.; Pat. & Lagerh. Bull. Soc. Myc. France **8**: 123. 1892.

This species was described from Ecuador on some unidentified species of *Piperaceae.* Material in the herbarium of the New York Botanical Garden from the type locality, and presumably a part of the original collection, is on *Peperomia pellucida* H.B.K., a species which is also widely distributed in the West Indies and Central America.

4. ALBUGO IPOMOEAE-PANDURANAE (Schwein.) Swing. Jour. Myc. **7**: 112. 1891

Aecidium Ipomoeae-panduranae Schwein. Schr. Natur. Ges. Leipzig **1**: 69. 1822.

Caeoma convolvulatum Link, in Willd. Sp. Pl. **6**[2]: 49. 1825.

Uredo Convolvulae Spreng. Syst. Veg. ed. 16. **4**: 572. 1827.

Aecidium Ipomeae Schwein.; Berk. Grevillea **3**: 60. 1874. (Hyponym.)

Cystopus Convolvulacearum Otth; Zalew. Bot. Cent. **15**: 223. 1883.

Cystopus Convolvulacearum Speg. Ann. Soc. Ci. Argent. **17**: 128. 1884.

Cystopus Ipomoeae-panduranae Stev. & Swing. Trans. Kan. Acad. Sci. **11**: 67. 1889.

Sori amphigenous or caulicolous, white or light-yellow, prominent, superficial, 0.5–20 mm., rounded, often confluent and frequently producing marked distortions of the host; conidiophores hyaline, clavate, unequally curved at base, about 15×30 μ; conidia short-cylindric, similar or the terminal more rounded, hyaline; the membrane with an equatorial thickening, usually very pronounced, 14–20 × 12–18 μ; oösporic sori separate from the conidial, caulicolous, rarely on the petioles, 1–2 × 5–6 cm. or even more, causing marked distortion of the host; oöspores light yellowish-brown, 25–55 μ; epispore papillate or with irregular, more or less curved ridges.

The position in the genus of this species has varied quite a little in the various elaborations which have appeared in recent years. Berlese and De-Toni * included it in *Cystopus Tragopogonis* from which it was separated by Saccardo.† According to Zalewski (*l. c.*) and Fischer ‡ it is placed next to *A. candida*, in the first instance on account of the structure of the epispore of the oöspore, and in the second as the result of inaccurate observations as to the thickness of the conidial membrane. In his *Monografia delle Peronosporacee*, Berlese attempts to accommodate the species to this varied treatment and so places *C. Ipomoeae-panduranae* next to *C. candida* on account of its conidial membrane having no equatorial thickening, and includes *C. Convolvulacearum* Speg. among those species which have an equatorially thickened conidial membrane, and at the same time cites various species of *Convolvulaceae* as hosts of *C. Tragopogonis*. An examination of co-type material of Spegazzini's species leaves no doubt concerning its identity with the North American species. Three packets of the material distributed by Ellis and Everhart in their North

* Saccardo, Syll. Fung. **7**: 234. 1888.

† Syll. Fung. **9**: 340. 1891.

‡ Rabenh. Krypt. Fl. ed. 2. **4**[1]: 419. 1892.

American Fungi *1809* were examined. Berlese had previously * cited this as authentic material of the thin-walled species, but it proved to be the most pronouncedly thick-walled specimen at hand. In a conidium of 12 μ diameter the thickening frequently reaches 5 μ making the connecting strand of protoplasm but 2 μ.

The results of the morphological investigations of Stevens,† coupled with markings and general development of the epispore of the oöspore, lead to the conclusion that Zalewski was correct in his placing of the species. That the relationship of this species should long be in doubt is not surprising, as the oöspores which are borne in large galls on the stems of the host escaped notice until recently, while the conidia on the majority of hosts bear a superficial resemblance to those *A. Tragopogonis*. In all the material examined the conidia are short-cylindric, appearing in certain planes almost cubical, except in the case of those on *Ipomoea Batatas*, the sweet potato, which are very much more rounded than typically. It is not impossible that a distinct species occurs in this host.

ON CONVOLVULACEAE:

Calonyction aculeatum (L.) House, Florida, *Britton 419;* Oaxaca, *Holway 3735*.

Convolvulus incanus Vahl, Texas, *Heller 1910*.

Ipomoea Batatas (L.) Lam., Alabama, *Earle 2265;* Delaware, *Chester;* Louisiana, *Langlois* (N. Am. Fungi *1809*); Mississippi, *Earle* (Econ. Fungi *47*); New Jersey, *Arthur, Edis* (N. Am. Fungi *205*), *Stevens;* South Carolina, *Ravenel* (Myc. Univ. *815*), *Rolfs 1685;* Porto Rico, *Underwood & Griggs 8*.

Ipomoea carolina Pursh, Louisiana, *Langlois 598;* South Carolina, *Rolfs*.

Ipomoea lacunosa L., ? Kansas, *Swingle;* North Carolina, *coll. ign.*

Ipomoea leptophylla Torr., Kansas, * *Bartholomew* (Fungi Columb. *2003*).

Ipomoea mexicana A. Gray, New Mexico, *Mulford 920;* Mexico (city), *Pringle 6607*.

---

* Icon. Fung. Phyc. 7. 1898.

† Bot. Gaz. 38: 300–302. *f. 1, 2.* 1904.

Ipomoea pandurata L., Alabama, *Carver;* Delaware, *Commons;* Florida, *Hume 79, Nash 1889, Tracy 7155;* Georgia, *Underwood;* Illinois, *Hart;* Indiana, *Arthur, Olive;* Missouri, *Kellerman, Galloway, Tracy & Galloway;* New Jersey, * *Halsted 164* (Econ. Fungi *377*, also conidia as *336*), *Stevens;* Ontario, * *Dearness;* Virginia, *Paul* (Fungi Columb. *2004*).

Ipomoea Pes-caprae L., Bahamas, *Hitchcock;* Porto Rico, *Heller 1396*.

Ipomoea simulans Hanbury, Morelos, *Pringle 6565*.

Ipomoea triloba L., Arizona, *LeRoy, Pringle*.

Pharbitis hederacea (L.) Choisy, District of Columbia, *Williams;* Georgia, *Underwood;* Illinois, *Seymour;* Indiana, *Olive, Underwood;* Kansas, *Bartholomew* (Fungi Columb. *2002*); Kentucky, *Kellerman;* Louisiana, *Langlois 589;* Missouri, *Galloway, Pammel;* Nebraska, *Williams;* New Jersey, *Halsted* (Econ. Fungi *334b, 334c*) *Stevens;* South Carolina, *Ravenel* (Fungi Am. *501*), *Rolfs 1686;* Virginia, *Seymour* (Econ. Fungi *334a*).

Pharbitis purpurea (L.) Voigt, Georgia, *Underwood;* Mississippi, *Tracy*.

Thyella tamnifolia (L.) Raf., Cuba, *Britton & Shafer 679*.

The following additional hosts are reported within our limits: *Convolvulus sepium* L., *Ipomoea incarnata* Vahl, *I. Jalapa* Michx., and *Quamoclit Quamoclit* (L.) Britton.

TYPE LOCALITY: North Carolina, on *Ipomoea "pandurana"* L.

DISTRIBUTION: Ontario to California, Central America and the West Indies. Also in South America, Europe, Asia and Africa.

5. ALBUGO LEPIGONI (de Bary) Kuntze, Rev. Gen. Pl. **2**: 658. 1891

Erysibe sphaerica β Caryophyllacearum Wallr. Fl. Crypt. Germ. **2**: 193. 1833.

Cystopus Lepigoni de Bary, in Rabenh. Fungi Europ. *483*. 1863.

Cystopus argentinus Speg. Bol. Acad. Ci. Cordoba **11**: 28. 1887.

Caulicolous or epiphyllous; sori rounded or elongate, 1–3 mm., yellowish; conidiophores clavate; conidia with the membrane of uniform thickness throughout, of two kinds, the terminal larger, hyaline or light-yellow, globular, 25–30 μ, the membrane about 5 μ

thick, the lower smaller, hyaline, globose or ovoid, 18–25 × 18–23 μ, membrane about 1–2 μ thick; oōspores produced in the leaves and stems of the host, 50–65 μ, light-brown, finely and densely papillate or echinulate, the tubercles showing a tendency to be confluent and form short ridges.

Infesting as it does only the maritime *Caryophyllaceae*, this species is of necessity restricted in its habitat, yet appears to be as widely distributed as its chief host, *Tissa marina*, from which it was originally described. Material has been examined from various European countries and from Algiers. Hennings * also reports it from South America. What is presumably the same species is described as *Cystopus argentinus* by Spegazzini, who fails to give really distinguishing characters by which it can be separated from the present species. The morphology of the species has been studied by Ruhland.†

ON CARYOPHYLLACEAE:

Tissa leucantha (Robs.) Greene, California, *Parish 4462.*

Tissa marina (L.) Britton, California, *Parish;* New York, *Britton.*

TYPE LOCALITY: Germany, on *Arenaria marina* L. = *Tissa marina* (L.) Britton.

DISTRIBUTION: New York and California. Also in South America, Europe and Africa.

6. **Albugo Swertiae** (Berl. & Kom.)

Cystopus Convolvulacearum Speg. var. *Swertiae* Berl. & Kom.; Berl. Riv. Pat. Veg. **9**: 26. 1900.

The only known locality for this species is the Amur region in eastern Siberia where it was collected on *Swertia connata* Schrenk by Komarof. An examination of this material shows the present species to be very closely related to *A. Tragopogonis*, yet quite distinct. Species of *Swertia* and the closely related genus *Frasera* have a wide distribution in North America.

7. ALBUGO TRAGOPOGONIS (DC.) S. F. Gray, Nat. Arr. Brit. Pl. **1**: 540. 1821

Uredo candida β Tragopogi Pers. Syn. Meth. Fung. 233. 1801.
Uredo Tragopogi DC. Fl. France **2**: 237. 1805.

* Hedwigia **35**: 210. 1896.
† Hedwigia **41**: 179. 1902.

Cystopus spinulosus de Bary, in Rabenh. Fungi Europ. *479*. 1862.
Cystopus cubicus de Bary, Ann. Sci. Nat. IV. **20**: 132. 1863.
Cystopus pulverulentus B. & C. Jour. Linn. Soc. Bot. **10**: 357. 1869.
Cystopus brasiliensis Speg. Bol. Acad. Ci. Cordoba **11**: 481. 1889.
Albugo spinulosa Kuntze, Rev. Gen. Pl. **2**: 658. 1891.
Cystopus Tragopogonis spinulosus Davis, Trans. Wis. Acad. **11**: 165. 1897. (Hyponym.)
Cystopus Mikaniae Speg. Ann. Mus. Nac. Buenos Aires III. **1**: 67. 1902.

Sori hypophyllous or caulicolous, prominent, deep-seated, white or yellowish, pulverulent, rounded or elongate, 1–3 × 1–8 mm.; conidiophores hyaline, clavate, about 12–15 × 40–50 μ; conidia light-yellow or hyaline, short-cylindric, the terminal larger and less angular than the lower, membrane with an equatorial thickening, 12–15 × 18–22 μ; oōspores produced in the stems and leaves of the host, dark-brown or almost black at maturity, very opaque, 44–68 μ; epispore reticulate, areolae 2 μ, wing bearing papillate tubercles at its angles.

The oōspores, which are produced in the leaves or rarely in the stems of the host, have been examined from a number of American and European specimens on hosts representing *Ambrosiaceae*, *Cichoriaceae* and various tribes of *Carduaceae*. The wing of the reticulation is lowest in specimens from the first families mentioned, while those on *Carduus* are scarcely more pronounced. The oōspores from various species of *Senecio* have the widest wing, while those from *Matricaria* are intermediate between those last mentioned. Oōspores produced on *Parthenium* have broader and lower reticulations than do the majority of specimens examined. It is however apparent that the American as well as the European material on the tribes *Cynareae*, *Senecioneae*, *Anthemideae* and *Heliantheae* belong to the same species. The only other North American hosts of this family for an *Albugo*, so far as is known, are of the tribe *Inuleae*. As no American material on these hosts contained oōspores, they were studied from European specimens and found to be identical with those produced on other members of *Carduaceae*. It appears from this that the American material from hosts of this tribe should be referred to the present species.

While there are minor differences in the conidia and in the rela-

tive size of the areolae of the oōspores, there do not appear to be sufficient grounds for the separation of the material examined into additional species. Especially is this true in regard to de Bary's *Cystopus spinulosus*, which is supposed to have pronounced spines on the oōspore. Dr. A. Fischer has examined the type specimen of this species and declares the character unreliable.* This is borne out by the more recent investigations of Dr. Magnus.† Since then Berlese has figured the spinulose oōspores,‡ using the material distributed by von Thümen (Myc. Univ. *1423*) on *Inula salicina* from Parma. The figures of the entire oōspores have a spinulose appearance due to the projection of the reticulations beyond the margin of the spore. The figure of an enlarged portion of the epispore looks very unlike anything found by me in the packet of this material, or, for that matter, in any other, as no such epispore has been observed by me in any specimen of the genus.

South American material from hosts of the tribes *Astereae* and *Eupatorieae* was examined. Oōspores similar to those produced on species of other tribes of this family were found on *Ageratum conyzoides* from Ecuador. From the same host Ule, in 1884, collected material in Brazil which has been referred to *Albugo brasiliensis* (Speg.) P. Hennings § and which was issued in Rabenhorst-Winter-Pazschke Fungi Europaei *3873* as *Cystopus Tragopogonis*. From a comparison of these two South American specimens it appears that Spegazzini's species is merely a synonym of *A. Tragopogonis*. Two other South American species, *Cystopus Mikaniae* Speg. and *Albugo Solivae* Schröt., have been described, but no material of either is at hand for examination. Inasmuch as the original descriptions of these species are scarcely distinctive and the hosts are closely related to species known to be hosts of *A. Tragopogonis*, it is very probable that they are also synonyms of that species. In addition to the above, another species, *Cystopus pulverulentus* B. & C., was described from an unidentified species of *Compositae* from Cuba. According to Dr. Farlow ‖ the type "cannot be traced in Herb. Curtis by the number cited in the original

* Rabenh. Krypt. Fl. ed. 2. 1^4: 422. 1892.
† Ber. Deutsch. Bot. Ges. 11: 327–330. *pl. 15*. 1893.
‡ Icon. Fung. Phyc. *pl. 5*. 1898.
§ Hedwigia 35: 212. 1896.
‖ Bibl. Index N. Am. Fungi 1: 177. 1901.

description." As the latter is too vague to allow of a more definite determination than would the mere citation of the host, this species had probably best be placed with the present one. The morphology of this species has been studied by Stevens.*

ON AMBROSIACEAE:

Ambrosia artemisiaefolia L., Alabama, **Carver 180*; Illinois, **Hart*; Kansas, **Swingle 1667*; Massachusetts, **Farlow* (N. Am. Fungi *205b*), **Seymour*; Missouri, **Demetrio* (N. Am. Fungi *2421*); New Jersey, **Halsted* (Econ. Fungi *291a*), *Stevens*; New York, *Underwood*; South Dakota, *Chaney, Williams* (Econ. Fungi *291b*); Wisconsin, *Pammel.*

Ambrosia psilostachya DC., Iowa, **Macbride*; South Dakota, *Rydberg 798*; Utah, *Macbride.*

Ambrosia trifida L., Kansas, *Swingle.*

Gaertneria acanthocarpa (Hook.) Britton, Utah, **Garrett* (Fungi Columb. *2205*).

Iva ambrosiaefolia A. Gray, Arizona, **Griffiths* (W. Am. Fungi *336*, on "*Franseria tenuifolia* Gray"); New Mexico, *Tracy 810.*

Iva ciliata Willd., Illinois, **Hart*; Missouri, **Hart.*

ON CARDUACEAE:

Artemisia biennis Willd., Montana, *Anderson & Kelsey.*

Carduus arvensis (L.) Robins., New York, *Arthur, Brown*, **Halsted* (Econ. Fungi *302*), *Stevens, Underwood*; Ontario, *Dearness.*

Carduus lanceolatus L., Newfoundland, *? Waghorne.*

Carduus muticus (Michx.) Pers., Minnesota, *Holway 241*; Ontario, *Dearness.*

Carduus spinosissimus Walt., Louisiana, **Langlois 335.*

Matricaria matricarioides (Less.) Porter, California, **Abrams 2487*; Oregon, **Lloyd.*

Parthenium integrifolium L., Iowa, **Arthur.*

Parthenium repens Eggert, Kansas, *Hitchcock 1086.*

? Senecio cymbalaroides Nutt., Montana, *Kelsey.*

Senecio Hartianus Heller, Colorado, *Rydberg & Vreeland 5499.*

* Bot. Gaz. **32**: 85, 97, 259. *pl. 3; pl. 4, f. 43, 53.* 1901.

Senecio oblanceolatus Rydb., Colorado, *Demetrio* (N. Am. Fungi *2208*, on "*S. aureus.*" The host is mixed but chiefly as cited here).

Senecio peninsularis Vasey & Rose, Baja California, **Palmer 659*.

Senecio serra Hook., Montana, **Kelsey*; Washington, **Piper*.

ON CICHORIACEAE:

Tragopogon porrifolius L., Massachusetts, *Farlow* (N. Am. Fungi *205b*); New Jersey, *Halsted* (Econ. Fungi *445*); New Mexico, **Mulford 1285a*; New York, *Arthur*, *Underwood*.

The following additional hosts are reported within our limits: *Antennaria plantaginifolia* (L.) Richards., *Artemisia canadensis* Michx., *Gaertneria discolor* (Nutt.) Kuntze, *Senecio aureus* L., *S. lugens* Richards., and *S. serra integriusculus* A. Gray.

TYPE LOCALITY: Europe, on *Tragopogon porrifolius* L.

DISTRIBUTION: Newfoundland to Washington, Baja California and Alabama. Also in South America, Europe, Asia, Africa and Australia.

8. ALBUGO QUADRATA (Kalchb. & Cooke) Kuntze, Rev. Gen. Pl. **2**: 658. 1891

This species is known only from Cape Colony, where it was collected on *Herpestis verticillaris* Nees by McOwen. The conidia are most nearly like those of *A. Tragopogonis*, but in the absence of oöspores it is impossible satisfactorily to refer the species to a place in the genus.

9. **Albugo Tillaeae** (Lagerh.)

Cystopus Tillaeae Lagerh.; Pat. & Lagerh. Bull. Soc. Myc. France **8**: 167. 1891.

No material of this species has been examined; but the description indicates a close relationship with *A. Bliti*. It is known only from Quito, Ecuador, the type locality, where it occurs on *Tillaea rubescens* H.B.K. Species of this genus occur sparingly in tropical America.

10. ALBUGO BLITI (Biv.) Kuntze, Rev. Gen. Pl. **2**: 658. 1891

Uredo Bliti Biv. Stirp. Rar. Sicilia **3**: 11. 1815.
Caeoma Amaranthi Schwein. Trans. Am. Phil. Soc. II. **4**: 292. 1832.
Cystopus Bliti de Bary, Ann. Sci. Nat. IV. **20**: 131. 1863.
Cystopus Amaranthi Berk. Grevillea **3**: 58. 1874.
Cystopus Amaranthacearum Zalew. Bot. Cent. **15**: 223. 1883.
Cystopus Cyathulae Winter; Roum. Rev. Myc. **11**: 66. 1889.

Sori amphigenous, white or very light-yellow, prominent, subsuperficial, rounded, sometimes confluent, 1–10 mm.; conidiophores hyaline, cylindric, about 15 × 60 μ; conidia hyaline, elliptic, the terminal smaller, globular; the membrane with an equatorial thickening, 8–15 × 15–20 μ; oöspores produced in the leaves of the host, dark-brown, 50–60 μ, averaging 55 μ; epispore coarsely reticulate, areolae 6–8 μ.

According to Zalewski (*l. c.*) there are two species of *Albugo* on the genus *Amaranthus*, the first, *Cystopus Bliti*, being confined to *Amaranthus Blitum*, while the second, *C. Amaranthacearum*, infests the other species of the genus. The points of distinction are confined to the oöspore and are of questionable value, although their reliability could not be disproved on account of a lack of authentic European material. The oöspores of *C. Bliti* are said to be formed only on the stem of the host, to vary from light- to dark-brown in color and to have irregular reticulations. Those of *C. Amaranthacearum* are borne in the leaves of the host, are of a uniform dark-brown and are regularly reticulate. The only specimen at hand on undoubted *Amaranthus Blitum* contains a few detached leaves with conidia only. That the place of oöspore-production cannot be regarded as of taxonomic value is evident, as this varies with the host in *A. candida* and in the same host in *A. Portulacae*. The color of the oöspore depends entirely upon maturity and may show remarkable variation just as do those of the present species in all specimens examined. The pattern of the reticulations cannot be taken as a taxonomic character unless accompanied by other marked distinctions, as the pattern is practically the same, or at most a modification of the same basic pattern, in *A. Bliti*, *A. platensis*, and *A. Portulacae*. In all of these

species it is by no means uncommon to find that a number of contiguous areolae are only imperfectly separated from each other by simple or even branched reticulations which end blindly before reaching the opposite side of the areola, thus producing a more or less complex labyrinth of ridges in place of the regular pentagonal or hexagonal reticulations which are typical of this group of species. The morphology of this species has been studied by Stevens.*

ON AMARANTHACEAE:

Acnida tamariscina tuberculata (Moq.) Uline & Bray, Iowa, **Arthur*.

Amaranthus Bigelovii Uline & Bray, Texas, *Heller 1867*.

Amaranthus blitoides S. Wats., California, *Underwood;* Montana, *Reynolds;* Washington, **Suksdorf 182*.

Amaranthus emarginatus Salzm., Guadeloupe, *Duss 4067*.

Amaranthus graecizans L., Montana, **Anderson*.

Amaranthus hybridus L., Alabama, *Earle 2264;* Florida, *Hitchcock 293;* Illinois, *Hart*, **Waite;* Indiana, *Underwood* (Ind. Fl. *99*), *Wilson;* Iowa, **Hitchcock;* Kansas, *Norton 425;* Missouri, *Bush 316*, **Tracy & Galloway;* Nebraska, *Williams;* New Jersey, **Halsted* (Econ. Fungi *352*), **Stevens;* New York, *Peck* (Roum. Fungi Sel. *4551*), *Shear* (N. Y. Fungi *198*), *Underwood;* Wisconsin, **Davis*, *Pammel*.

Amaranthus Palmeri S. Wats., New Mexico, *Metcalfe 719;* Chihuahua, **Pringle 1112;* Jalisco, *Palmer*.

Amaranthus retroflexus L., Alabama, *Earle;* Illinois, *Burrill*, *Earle;* Indiana, **Bolley*, *Olive;* Iowa, **Arthur;* Massachussetts, **Farlow* (N. Am. Fungi *206*), *Seymour* (Econ. Fungi *254b*); New Jersey, **Stevens;* New York, *Halsted* (Econ. Fungi *354a*), *Jelliffe*, *Peck* (Myc. Univ. *619*), *Underwood 396;* Ontario, *Dearness* (Fungi Columb. *46*); South Dakota, **Griffiths* (W. Am. Fungi *33*); Wisconsin, *Pammel*.

Amaranthus spinosus L., Illinois, **Earle;* Indiana, *Rose;* Louisiana, *Ball 662;* Texas, **Long* (Fungi Columb.

* Bot. Gaz. 28: 149, 233. *pl. 11–15.* 1900.

1709), *Stanfield;* Virginia, *Heller 1023;* Mexico, *Berlandier;* Porto Rico, *Millspaugh.*

Amaranthus tristis L., Grenada, *Broadway;* St. Croix, *Ricksecker 109.*

Amaranthus viridis L., Florida, * *Hitchcock 298*, *Nash 2179.*

Cladothrix lanuginosa (Moq.) Nutt., Kansas, *Hitchcock 431;* New Mexico, *Wooton;* Mexico, *Berlandier.*

Cyathulæ lappulacea Moq., New York, *Peck* (Roum. Fungi Sel. *4863*).

Also reported from within our limits on the following additional hosts: *Acnida cannabina* L., *A. tamariscina* (Nutt.) Willd., *Amaranthus crispus* (Lesp. & Thev.) Braun, and *A. hybridus paniculatus* (L.) Uline & Bray.

TYPE LOCALITY: Sicily, on *Amaranthus Blitum* L.

DISTRIBUTION: Vermont to Washington, Mexico, Florida and the West Indies. Also in South America, Europe, Asia and Africa.

11. ALBUGO PLATENSIS (Speg.) Swing. Jour. Myc. 7: 113. 1892

Cystopus platensis Speg. Rev. Argent. Hist. Nat. 1: 32. 1891.

Hypophyllous, sori at first pallid, later surrounded by a purplish line, irregular in outline, 1–5 mm., scattered or gregarious, prominent; conidiophores cylindric, about 40–45 × 15 μ; conidia elliptic, 20–22 × 18–20 μ, very light-yellow, the membrane with an equatorial thickening which is darker-colored in the smaller terminal conidium; oöspores borne in the leaves of the host, very opaque, very dark-brown, globular, 55–85 μ, averaging 60 μ, finely reticulate, areolae about 4 μ.

This species is very closely related to *A. Bliti*, from which it is, however, quite distinct. The conidia of *A. Bliti* are hyaline and white in mass while those of *A. platensis* are slightly colored, appearing light-yellow in mass while the apical conidium has a darkened equatorial band. The oöspores, which are produced in the leaves of the host in both species, are very similar and at first sight indistinguishable. Those of *A. platensis* are very dark-brown, so opaque that until treated with HCl they appear as black grains, and are finely reticulate, while those of *A. Bliti* are lighter in color, less opaque, slightly smaller in size and more coarsely reticulate, the areolae being from one third to one half larger.

ON ALLIONIACEAE:

Boerhaavia anisophylla A. Gray, New Mexico, *Wooton 462.*

? Boerhaavia diffusa L., McComb's Expedition, *Newberry.*

Boerhaavia erecta L., Florida, *Swingle 4139;* Sonora, *Palmer;* Jamaica, *Harris 6853;* St. Croix, *Ricksecker 401.*

Boerhaavia hirsuta Willd., Texas, * *Long* (Fungi Columb. *1605*, on "*B. decumbens*"); Yucatan, *Gaumer 309;* Cuba, *Britton & Shafer 1;* Guadeloupe, *Duss 2174;* Porto Rico, *Goll 536.*

Boerhaavia paniculata Rich., Culebra, *Britton & Wheeler 2.*

Boerhaavia spicata Choisy, Arizona, *Griffiths 2071;* New Mexican, *Wooton.*

Boerhaavia Xanti S. Wats., Sonora, *Palmer.*

Wedelia incarnata (L.) Kuntze, Arizona, *Rusby;* New Mexico, *Skehan 102, Wooton;* Texas, *Seler 1901;* Utah, *Goodding 809;* San Luis Potosi, *Schaffner 562.*

Reported from within our limits on the following additional hosts: *Boerhaavia Sonorae* Rose and *B. viscosa* Lag. & Rodr.

TYPE LOCALITY: Buenos Aires, Argentina, on *Boerhaavia hirsuta* Willd.

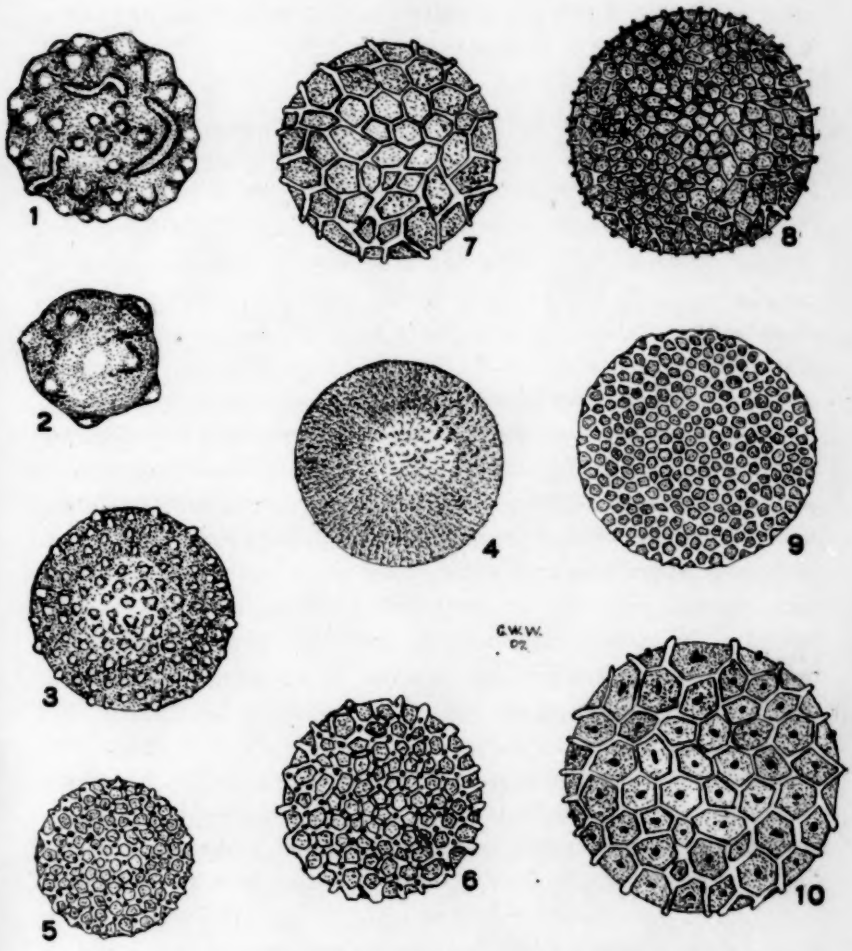
DISTRIBUTION: Utah to peninsular Florida, southern Mexico and the West Indies. Also in South America, Asia and Africa.

12. **Albugo occidentalis** sp. nov.

Soris hypophyllis, subrotundis vel irregularibus, rarius confluentibus, superficialibus, prominentibus, subflavidis, 1–3 mm. crassis; conidiophoris cylindraceis, circa 12 × 40 μ; conidiis flavidis, breviter cylindraceis, 14–20 × 8–16 μ, membrana hyalina, ad medium annulo cincta; oosporis in hospitis foliis, globosis, luteo-brunneis, regulariter tenuiterque reticulatis, 50–60 μ diametro, areolis pentagonis vel hexagonis, circa 2 μ crassis.

Sori hypophyllous, rounded or irregular in outline, sometimes confluent, superficial, prominent, yellowish, 1–3 mm.; conidiophores cylindric, about 12 × 40 μ; conidia discoid, the membrane hyaline with an equatorial thickening, contents yellow, 14–20 × 8–16 μ; oöspores borne in the leaves of the host with the conidia, globular, 50–60 μ, yellowish-brown, very closely and shallowly reticulate, areolae about 2 μ.

Type in herbarium of the New York Botanical Garden, *L. M. Underwood & A. D. Selby 108*, from the hills about Box Cañon,



Oöspores of *Albugo*. (All × 500.)

1. *A. candida*, from *Raphanus sativus*, in Fungi Columbiani *1805*.
2. *A. tropica*, from *Peperomia pellucida*, Ecuador, ex Herb. Lagerheim.
3. *A. Ipomoeae-panduranae*, from *Ipomoea pandurata*, in Economic Fungi *337*.
4. *A. Lepigoni*, from *Lepigonum medium*, in Fungi Europaei *483*.
5. *A. Swertiae*, from *Swertia connata*, in Fungi Rossiae Exsiccati *301*.
6. *A. Tragopogonis*, from *Tragopogon porrifolius*, Mulford *1285a*.
7. *A. Bliti*, from *Amaranthus hybridus*, in Economic Fungi *352*.
8. *A. platensis*, from *Boerhaavia decumbens*, in Fungi Columbiani *1605*.
9. *A. occidentalis*, from *Blitum capitatum*, type specimen, Underwood & Selby *108*.
10. *A. Portulacae*, from *Portulaca oleracea*, in West American Fungi *31*.

west of Ouray, Colorado, September 8, 1901, at an altitude of 2,300–2,500 m. On *Blitum capitatum* L.

ON CHENOPODIACEAE:

Blitum capitatum L., Colorado, * *Underwood & Selby 108.* (Type.)

Chenopodium rubrum L., Montana, *Kelsey.*

This material was referred in the herbarium of the New York Botanical Garden to *A. Bliti*, but a superficial examination of the conidia was sufficient to throw doubt upon the correctness of the identification. The conidia differ in their yellow color and in their discoid form from those of *A. Bliti*, and from those of *A. platensis* in the brighter color and uniformly hyaline membrane, while in outline they approach most nearly to those of *A. tropica*. The oöspores, however, are markedly different from those of these species or of any other member of the genus. They are very closely reticulate, with the areolae so shallow as at first sight to give the appearance of pitting rather than reticulations. This is our rarest and most local species, yet none are more markedly distinct. It is represented in the material examined by only two collections, while but one American mycologist has referred to an *Albugo* which could belong to the present species. The inclusion by Berlese and DeToni * of *Atriplex* among the hosts of *A. Bliti* appears to be the first mention of a species of this genus on a Chenopodiaceous host. No locality is given nor can the host be traced by any bibliographical assistance at hand. Later Pammel † reported the occurrence of *A. Bliti* upon the sugar beet in Iowa and mentions its occurence on *Blitum*. He figures the conidia from *Beta* and the oöspores from *Amaranthus*, as they were not found on the former host. Later the same author ‡ cites references to the occurrence of *A. Bliti* on *Chenopodium* in Europe, but no light has been gained from them.

DISTRIBUTION: Montana and Colorado. Probably also in Iowa and Europe.

---

* Sacc. Syll. Fung. 7: 236. 1888.

† Bull. Iowa Agr. Expr. Sta. 15: 236. *pl. 6.* 1891.

‡ Jour. Myc. 7: 102. 1892.

13. ALBUGO PORTULACAE (DC.) Kuntze, Rev. Gen. Pl. **2**: 658. 1891

Uredo Portulacae DC. Fl. France **5**: 88. 1815.
Cystopus Portulacae de Bary, Ann. Sci. Nat. IV. **20**: 131. 1863.

Sori white or yellowish, on all parts of the host except the roots, rounded or irregular in outline, up to 5 mm.; conidiophores clavate, about 9 × 25 μ, hyaline; conidia dissimilar, the terminal larger, cylindrical and papillate, the basal smaller, subglobular, about 12–15 × 15–22 μ, walls hyaline, contents light-yellow; oōspores borne in the stems and leaves, globular, dark-brown, about 70 μ; epispore regularly reticulated, with short ridges or papillate tubercles in the areas.

This species is restricted throughout its range to a single host, upon which it does not appear to be very common, although the distribution of both host and fungus is probably coextensive. It is easily distinguished from related species by the uniform thickness of the conidial membrane and by the tubercles in the areolae of the oōspore. The morphology of this species has been studied by Stevens.*

ON PORTULACACEAE:

Portulaca oleracea L., Connecticut, *Underwood;* Georgia, **Underwood;* Illinois, *Blount, Burrill,* **Earle, Waite;* Indiana, *Bolley, Olive,* **Underwood;* Iowa, **Arthur;* Missouri, *Galloway;* New Jersey, *Ellis* (N. Am. Fungi *1808*), *Halsted* (Econ. Fungi *264a*); New York, *Underwood;* New Mexico, **Cockerell;* Ohio, *Tyler* (Ohio Fungi *83*); Ontario, *Dearness* (Fungi Columb. *45*, Econ. Fungi *264b*); South Carolina, *Ravenel* (Fungi Am. *500*); South Dakota, **Chaney,* **Griffiths* (W. Am. Fungi *31*).

TYPE LOCALITY: France, on *Portulaca oleracea* L.

DISTRIBUTION: Vermont to South Dakota, New Mexico and Georgia. Also in South America, Europe, Asia and Africa.

SPECIES EXCLUDENDAE

While several names have been proposed under this genus which for one reason or another cannot be retained, it appears scarcely necessary to mention any of these which have not gained admission to Saccardo's *Sylloge Fungorum.*

* Bot. Gaz. **32**: 79, 97, 254. *pl. 1; pl. 4, f. 44–46, 48–50.* 1901.

Cystopus Euphorbiae Cooke & Massee, Grevillea **20**: 106. 1892.

The roughened conidia bespeak a closer relationship with the Uredinales than with the present genus.

Cystopus Salsolae and *C. Schlechteri* P. Sydow, Hedwigia Beibl. **38**: 142. 1889.

Authentic material of both these species has been examined. In both instances the host is covered with white spots which closely simulate the sori of *Albugo* and answer to the description in the diagnoses of these species. A microscopic examination of these spots failed to show anything except crystals of some chemical. These answer fairly well to the measurements given, but show no membrane or other parts as described, for the spores. Nothing more similar to conidia, however, was observed. The spores described as oöspores are present in fair abundance in the material of both species. They are borne apparently singly, at the apex of isolated conidiophores, and are the conidia of some species of Hyphomycetes and rather closely related to *Coniosporium* or *Torula*.

NEW YORK BOTANICAL GARDEN.

Some Lactarii from Windham County, Vermont

GERTRUDE SIMMONS BURLINGHAM

Vermont is undoubtedly one of the richest of the New England states in the number and variety of its fleshy fungi; yet with the exception of the lists of Charles C. Frost,* and a paper by Professor Burt,† nothing has been published to indicate any extended study of the higher *Basidiomycetes* which occur in the state. In connection with a special study of the genus *Lactarius*, it was my fortune to spend last summer collecting in that portion of Windham county, Vermont, immediately north of the region explored by Frost. Six miles west of Newfane village, at an elevation of about 500 meters, we "pitched camp" in a small farmhouse delightfully situated in the midst of the fragrance and the sunshine and the bird voices of the mowing,‡ while closely encircling it on three sides was the forest with the more subtle odors, the cool shade, and the songs of the veery and the hermit thrush. Although the most extensive field work was done in the town of Newfane, several excursions were made into the neighboring townships reaching west to Stratton Mountain, and east to Putney Mountain, including a range of elevation from 180 to 615 meters.

The topography of the region is characterized by a succession of hill-like mountains with intervening valleys traversed by some small stream whose waters finally reach the larger valley of the West River. The elevations are mostly covered with timber, and lower lands which were tilled two generations ago are, in some cases, being reclaimed by the forests. Except along the Connecticut and the lower valley of the West River, chestnut groves are lacking. There are a few scattering oaks, but no rich oak woods. The white pines, too, are scarce in this part of Vermont,

* Tuckerman and Frost. Catalogue of plants within thirty miles of Amherst College. 1875.

† Key to the genera of the *Basidiomycetes* of Vermont. 1899.

‡ "Mowing" is used in New England for any land from which hay is cut, while the term "meadow" is restricted to level and usually moist grass lands.

but the young trees grow rapidly where given an opportunity. Forests of balsam fir, spruce, and hemlock are numerous. The deciduous woods are made up principally of maples, beeches, yellow and paper birch, and aspens. Along small streams, alders abound. The soil is a loam or a sandy loam, with a topsoil of vegetable mold in the less steep and rocky woods.

From the middle of July to the middle of September the weather was unusually dry. Consequently there was a scarcity of the *Lactarii* except in naturally moist woods, and in wooded ravines. The swamps were not as a rule good collecting grounds, owing to the fact that they were so often supplied by cold springs. Nevertheless the region, with its varying elevations, diverse forest conditions, and shaded ravines, proved a most fruitful collecting field. During July and August, after a light rain or even a heavy dew, *Boleti* and *Russulae* were very abundant in the more open places in the woods; by the middle of August the *Cortinarii* began to be plentiful; and from first to last many other genera were represented by a lesser number of species. But in the present paper I shall attempt to cover merely the summer's work upon the genus *Lactarius*.

The absence of *Lactarius piperatus* was notable, but the related form, *Lactarius deceptivus* Peck, was very common throughout the region. Two species were found which have not been reported before in the United States; namely, *Lactarius resimus* Fr.,* and *Lactarius circellatus* (Batt.) Fr. *Lactarius rimosellus* also should be mentioned as a species recently described by Dr. Peck (Rep. State Bot. N. Y. **1905**: 37. 1906). *Lactarius oculatus*, which was described by Peck as a variety of *Lactarius subdulcis*, is here separated as a distinct species, since the Vermont specimens were so plainly viscid when moist.

Many thanks are due Dr. Charles H. Peck for the privilege of examining the type specimens in the herbarium of the New York

* In the Rep. State Bot. N. Y. for 1872, Peck describes *Lactarius regalis*, which, in the Rep. State Bot. N. Y. for 1884 and 1885, he refers to *Lactarius resimus* as a variety. The type specimens show the plant in various stages including forms young enough to have tomentum on the margin. From the absence of this tomentum in the five type specimens, it would seem that they belong to a distinct species as first described; but further collections of this form must be made before its position can be positively determined.

State Museum, and for his assistance in determining doubtful forms; also to Prof. L. M. Underwood, under whose direction the study of the *Lactarii* is being pursued, and Dr. Marshall A. Howe, who placed at our disposal for the summer the house which we occupied, and otherwise rendered valuable assistance through his intimate knowledge of Newfane.

The following is the list of species taken, together with the description of new species.

Lactarius aspideoides sp. nov.

Pileus fleshy, rather firm, convex-umbilicate, then plane, becoming infundibuliform with age, 3–4.5 cm. broad, sulphur-yellow zoned with deeper yellow, zones narrow, sometimes obscure, very viscid when wet, gluten thick and persisting, margin involute and minutely tomentose at first; gills whitish then cream-colored spotted with yellow, close, sometimes forking next the stem, adnate but acute at the inner end, 4 mm. broad, staining lilac where wounded; stem sulphur-yellow, often spotted with deeper yellow, viscid when young or wet, equal or abruptly smaller at the base, glabrous, stuffed, becoming hollow, 2–3.5 cm. long, 6–10 mm. thick; spores white, globular to broadly elliptical, echinulate, 5–7 by 7–8 μ; flesh whitish, changing faintly lilac where exposed to the air; milk white, a change in color indicated only by the change in the color of the broken flesh; taste bitter.

In a grassy place in hillside sheep-pasture near small fir trees, 523 m. elevation, after heavy rain and warm weather, September 21–24; Newfane.

This species is related to *Lactarius aspideus* Fries, but is separated from it by the brighter-colored *zoned* pileus, the smaller size, and the bitter taste of the milk. I could not detect any change in the color of a drop of milk, but the gills and flesh change to lilac where wounded. The tomentum on the margin of the young pileus is chaffy in appearance.

Lactarius Bensleyae sp. nov.

Pileus firm, fleshy, nearly flat with margin inrolled, papillate, when older depressed in the center but the margin still recurved, surface covered with a dense minute short rather stiff pubescence, dry, blue-black when young and moist, then zoned with dark-gray, finally with brownish-gray, darker in the center, 2–15 mm. broad; gills whitish, some forking near the stem, close, slightly decurrent; stem somewhat buff, covered more or less with a gray

pruinosity, glabrous, dry, nearly equal, becoming hollow, 1 cm. or less in length, 2–3 mm. thick; spores slightly cream-colored, mostly globular, some slightly elliptical, echinulate, 5–6.5 μ or rarely 6.5 by 8 μ; flesh of pileus gray, of stem buff; milk white, unchanging, acrid.

In black soil in a wet place at times overflowed, under yellow birch and young spruce woods, 500 m. elevation, July to September; Newfane, Agnes H. Bensley.

This species is gregarious and sometimes cespitose. As many as 35 were found growing in an area of less than one square foot. It can be distinguished from *Lactarius griseus* Peck, by its minute size, its dark-colored and frequently zoned pileus, and by the short and dense hirsute-pubescent covering of the pileus.

Lactarius isabellinus sp. nov.

Pileus fleshy, not very thick, convex, then broadly convex, at length infundibuliform, umbonate, dry, glabrous, but a little roughened and wrinkled in the center especially when mature, azonate, red-fulvous in the center, buff toward the margin, all fading to buff when mature, 3–4.5 cm. broad; margin glabrous, even or faintly striate when old, and sometimes areolate-wrinkled; gills pale-yellowish, becoming reddish where bruised, crowded, thin, forking near the stem or midway to the margin, slightly decurrent, 3 mm. broad, or twice as broad as the thickness of the flesh; stem the same color as the pileus, equal or slightly tapering upwards, tomentose at the base, stuffed, becoming hollow, 4 cm. long, 6 mm. thick; spores white, slightly echinulate, 6–7.5 by 7–8.5 μ; flesh white, staining yellowish from the milk; milk white, at length (after five minutes) becoming sulphur-yellow, astringent, then acrid, abundant.

In leaf mold, moist open place in mixed woods, 460 m. elevation, warm dry weather, September; Newfane.

The milk changes color slowly, and sometimes a drop will not seem to change, but the milk always dries yellow on the flesh. The species was found but once; then, however, several specimens in various stages of development.

Lactarius minusculus sp. nov.

Pileus fleshy, thin, broadly convex, with a small umbo, becoming plane then somewhat depressed in the center, glabrous, viscid in wet weather, sometimes shining with viscidity, azonate, fulvous in the center, shading to cream-fulvous, then to cream on

the margin, 1.1–3 cm. broad, margin minutely crenate, pruinose at first, in mature specimens slightly wavy and sometimes substriate; gills close, thin, adnate, seldom forking, broad for the thickness of the pileus; stem slightly paler than the pileus, equal, stuffed, a little tomentose at the base when growing in moss, about 2.5 cm. long, 4 mm. thick; spores white, subglobose, slightly echinulate, 6–8 μ; flesh isabelline-white; milk white, unchanging, acrid.

In moss or on decayed wood, under yellow birches, in cool, moist woods, 500 m. elevation, July; Newfane.

This species resembles *Lactarius subdulcis* somewhat, but differs in its smaller size, the viscidity of the pileus, the crenate margin, in being expallent, and in the acrid milk. The plants were found in the same general locality several times in July, always after a rain. Frequently the gills appear pruinose.

Lactarius nitidus sp. nov.

Pileus fleshy, rather thin, convex then depressed in the center, margin arching for some time, umbonate, glabrous, smooth, shining-viscid when wet, mahogany-red, more golden-red toward the margin, umbo persistently dark, otherwise fading when dry, 3 cm. broad; gills yellowish becoming pruinose, close, sometimes forking, slightly decurrent; stem mahogany-red, equal, smooth, glabrous, stuffed becoming hollow, 4.5–5 cm. long, 5–8 mm. thick, sometimes ventricose when growing in wet places; spores white, echinulate, 5–6 by 6–8 μ; flesh faintly buff, turning a little reddish where cut; milk white, unchanging, mild.

In a grassy sheep-pasture in the shade of hemlocks, and in woods, 500 m. elevation, warm weather, September; Newfane.

Lactarius oculatus (Peck) sp. nov.

Lactarius subdulcis oculatus Peck, Rep. State Bot. N. Y. **1902**: 37. 1903.

Pileus fleshy, thin, convex then depressed in the center, margin arched then nearly plane, umbonate, viscid in dew or wet weather, glabrous, smooth, rich-fulvous in the center shading to buff-fulvous toward the margin, except the umbo fading to pinkish, 1.5–2.5 cm. broad, margin pruinose at first, slightly crenate; gills whitish then yellowish, at length pruinose, crowded, a few forking near the stem; stem buff at the top, sublatericeous below the middle, equal, stuffed, tomentose at the base, slightly sticky in wet weather, up to 6 cm. long, 5 mm. thick; spores white, broadly elliptical to

subglobose, echinulate, 6–7.5 by 8–9.5 μ; flesh buff-whitish; milk white, unchanging, mild.

In moss under pine and hemlock, 500 meters elevation, July to September; Newfane.

"Pileus moist, subhygrophanous, vinaceous buff with a small central spot or umbo persistently reddish-brown or chestnut color. Otherwise like the species. Under spruce and balsam fir trees. September." Peck, Rep. State Bot. N. Y. **1902**: 37. *pl. 83, f. 20–24.* 1903.

Dr. Peck gave the name *oculatus* to the form on account of the eye-like appearance of the umbo in the mature or dry specimen. This spot is not noticeable in the moist condition. The viscidity of the pileus in wet weather, and the expallent color serve to separate it from *Lactarius subdulcis.*

In addition to the above, the following species were collected:

LACTARIUS AFFINIS Peck.

In moist fir or mixed woods with evergreens predominating, August to September, 500 m. elevation; Newfane.

LACTARIUS ALPINUS Peck.

Mossy moist place on border of fir woods, September, 500 m. elevation; Newfane.

LACTARIUS CAMPHORATUS (Bull.) Fr.

Common, July to September; Wardsboro; Stratton; Newfane; Putney. *Edible.*

LACTARIUS CINEREUS Peck.

Common in mixed woods, especially among beech leaves, most abundant in July and August; Newfane.

LACTARIUS CIRCELLATUS (Batt.) Fr.

In cool mixed woods, spruce and fir and hemlock predominating, August to September, 500 m. elevation; Newfane.

LACTARIUS DECEPTIVUS Peck.

Common especially under hemlocks, July to September; Newfane. *Edible.*

LACTARIUS DELICIOSUS (L.) Fr.

Common in moist places in fir, spruce, or hemlock woods, July to September; Newfane. *Edible.*

LACTARIUS FLEXUOSUS Fr.

Found twice under maples in leaves, rather dry, 500 m. elevation, September; Newfane.

LACTARIUS FULIGINOSUS Fr.

Found in mixed woods several times but not common, 500 m. elevation, August; Newfane.

LACTARIUS GERARDII Peck.

At foot of Stratton Mountain, under maple, balsam fir, and spruce, July, 615 m. elevation. *Edible.*

LACTARIUS GRISEUS Peck.

Common in wet woods on ground and on decaying wood, July to September, 180 to 615 m. elevation; Stratton; Newfane; Putney.

LACTARIUS HYSGINUS Fr.

In grassy wood road and in both leaf and needle soil, under fir and hemlocks, moist woods, August to September, 500 m. elevation; Newfane.

LACTARIUS LIGNIOTUS Fr.

Not common, a few scattering specimens, August to September, 500 m. elevation; Newfane.

LACTARIUS PALUDINELLUS Peck.

In moist places in woods, found once; Newfane.

LACTARIUS PARVUS Peck.

Found once on decayed wood in moist mixed woods, 500 m. elevation, September; Newfane.

LACTARIUS PYROGALUS (Bull.) Fr.

Grassy open place in woods, 500 m. elevation, July; Newfane.

LACTARIUS RESIMUS Fr.

Rare, found only one specimen, under spruce on edge of steep woods, 500 m. elevation, September; Newfane.

LACTARIUS RIMOSELLUS Peck.

Found several times under beech among ferns, near wood road, July to August, 500 m. elevation; Newfane. *Edible.*

LACTARIUS SUBDULCIS (Bull.) Fr.

Common in woods and on border of woods, especially in moist places, 180–615 m. elevation, June to September; Stratton; Newfane; Putney.

LACTARIUS SUBPURPUREUS Peck.

In grassy sheep pastures with scattered firs, after heavy rains. 530 m. elevation; September; Newfane.

LACTARIUS THEIOGALUS (Bull.) Fr.

Common in spruce and hemlock woods, in both dry and wet; weather, 180–500 m. ft. elevation, July to September; Newfane.

LACTARIUS TORMINOSUS (Schaeff.) Fr.

Common in moist woods, sometimes nearly white, 500 m. elevation, August to September; Newfane.

LACTARIUS TURPIS Fr.

Found three times in moist places; twice in fir woods, once in maple woods near a pine tree, 500 m. elevation, August to September; Newfane.

LACTARIUS UVIDUS Fr.

Common in *Sphagnum* in fir woods and under firs and alders in a wet ravine, 460 m. elevation, August, September; Newfane. Several of the specimens were attacked by a fungus which affected the hymenium only and did not prevent the flow of milk. This has been deposited with Dr. Peck for identification and description.

LACTARIUS VELLEREUS Fr.

Mixed woods and under beech, 180 to 615 m. elevation, August; Newfane.

LACTARIUS VOLEMUS Fr.

Found once in woods-road under maples and beeches, 500 m. elevation; and once in a moist ravine near Newfane village, August. *Edible.*

The accompanying synopsis is offered as an aid in identifying the above-named species. In order to make the synopsis as complete as possible, I have included the additional species which are given in Frost's list, most of which were probably collected in the vicinity of Brattleboro. These added species are indicated by an asterisk. In his list the names of eleven new species occur which have never been described; these are of course omitted.

Synopsis of species

MILK BRIGHT-COLORED FROM THE FIRST, wounds often turning greenish ..... Section I.
MILK AT FIRST WHITE THEN CHANGING COLOR ..... Section II.
MILK WHITE AND UNCHANGING ..... Section III.

I

Milk orange; pileus some shade of orange zoned with darker, fading; gills deep-orange with yellowish reflections ..... *L. deliciosus.*

Milk saffron-yellow; pileus grayish-yellow, somewhat zonate; gills grayish-yellow; under pines..... *L. Chelidonium.**

Milk dark-red; pileus pale reddish-purple approaching Indian lake, fading, faintly zonate; gills dark-red, fading..... *L. subpurpureus.*

Milk indigo-blue; entire plant indigo-blue; pileus with grayish lustre, zonate; gills becoming yellowish ..... *L. Indigo.**

II

Milk becoming sulphur-yellow..... **A.**

Milk becoming salmon; at least wounds changing; pileus dry; spores yellow..... **AA.**

Milk becoming lilac; at least wounds changing; pileus viscid..... **AAA.**

A

1. Pileus viscid ..... 2.

   Pileus dry, fulvous in center, buff toward margin, all buff when mature; stem same color; gills paler; milk changes slowly... *L. isabellinus.*

2. Margin at first involute, tomentose; pileus whitish, azonate, large, umbilicate ..... *L. resimus.*

   Margin glabrous or merely downy when young; pileus yellowish, salmon zoned with bister or fawn more or less distinct; stem same color or paler; gills whitish to yellow, becoming reddish where bruised; milk bitter then acrid..... *L. theiogalus.*

AA

Pileus sooty or the color of coffee and milk, surface smooth, pruinose in appearance, 2.5–6.5 cm. broad; gills subclose..... *L. fuliginosus.*

Pileus more velvety-pruinose, center often wrinkled, umbonate, rich dark umber to sepia, 2.5–10 cm. broad ..... *L. ligniotus.*

AAA

Pileus and stem sulphur-yellow; pileus zoned with deeper yellow; stem equal or abruptly smaller at the base, viscid, sometimes spotted; plants small; milk bitter..... *L. aspideoides.*

Pileus pale brownish-gray or drab, with lilac tint, center sometimes dark-brown to yellow-brown, sometimes faintly zonate, 5–8 cm. broad; wet places in woods..... *L. uvidus.*

III

1. Milk acrid..... 2.
   Milk mild..... 3.
2. Pileus viscid ..... 4.
   Pileus dry..... 11.
3. Pileus viscid when wet but soon dry, glabrous..... 18.
   Pileus dry ..... 21.
4. Margin at first involute, tomentose..... 5.
   Margin naked ..... 6.
5. Pileus pale-ochraceous tinged with flesh, sometimes nearly white, usually zonate, with beard-like tomentum persisting on margin, 7–10 cm. broad; gills white or yellowish ..... *L. torminosus.*

Pileus woolly-tomentose all over, fibrillose on margin, dingy-flesh-colored or reddish-buff, azonate, very viscid in wet weather, 4–10 cm. broad; milk scanty, *sometimes becoming pale-yellow.* ..... *L. cilicioides.**

Pileus olivaceous-umber, yellowish toward margin, agglutinated-villose, or at length glabrous, blackish in drying, 7–15 cm. broad; stem uneven or spotted; gills white, then yellowish, then gray, nearly black where bruised. ..... *L. turpis.*

6. Pileus some shade of yellow ..... 7.

Pileus some shade of red or fulvous ..... 9.

Pileus gray ..... 10.

Pileus livid or plum-colored, becoming yellowish, large and firm; stem stout, same color as pileus or paler, not spotted ..... *L. trivialis.*

7. Pileus zonate ..... 8.

Pileus azonate, ochraceous, up to 10 cm. broad; spores white; gills tinted yellow ..... *L. affinis.*

8. Pileus 6–11 cm. broad; stem often scrobiculate-spotted; spores yellow ..... *L. insulsus.**

Pileus 5–8 cm. broad; stem never spotted ..... *L. zonarius.**

9. Pileus dull garnet in center, paler toward margin, gluten persisting, 5–8 cm. broad, thin margin inflexed; stem often spotted, paler than pileus; gills white to yellowish ..... *L. hysginus.*

Pileus fulvous in center, buff-fulvous toward margin, margin finely crenate; gills white; plants small ..... *L. minusculus.*

10. Pileus cinereus, usually azonate, disk darker, 2–5 cm. broad, thin, fragile; gills close, white; stem often tomentose at base, paler than pileus, up to 8 cm. long ..... *L. cinereus.*

Pileus dark gray with lilac tints, zones and disk reddish-brown, fading to pale gray, 6–8 cm. broad; gills close ..... *L. circellatus.*

11. Pileus glabrous ..... 12.

Margin with a roll of cottony tomentum, or pileus velvety-tomentose ..... 16.

Pileus minutely hirsute-pubescent, or squamulose-tomentose ..... 17.

Pileus minutely squamulose, ochraceous to fulvous, 2.5–4 cm. broad; gills yellowish to ochraceous ..... *L. alpinus.*

12. Pileus some shade of red ..... 13.

Pileus whitish ..... 14.

Pileus some shade of gray ..... 15.

13. Pileus reddish-brown or lilac-brown, small, slender; gills close, white or yellowish, dingy-greenish where wounded; on decaying wood ..... *L. parvus.*

Pileus bay-red, shining, sometimes floccose-pubescent when young, 5–11 cm. broad; gills ochraceous or reddish; milk very acrid .. *L. rufus.**

14. Pileus umbilicate to infundibuliform, 6–18 cm. broad; stem solid, short, or 2–8 cm. tall; gills very close, dichotomous, arcuate, decurrent ..... *L. piperatus.**

Pileus thinner than preceding, 5–10 cm. broad; stem 5–10 cm. high; gills adnate, horizontal, white to yellowish ..... *L. pargamenus.**

15. Pileus livid-gray, zoned, moist but not viscid, 5–7.5 cm. broad; stem stuffed then hollow; gills thin, distant, subochraceous .. *L. pyrogalus.*

Pileus lead-gray or violet-gray, zoned or zoneless, smooth shining, then rivulose-scaly and unpolished, margin flexuose, 5–15 cm. broad; stem solid; gills thick, distant, light-yellowish ..... *L. flexuosus.*

16. Pileus convex-umbilicate to infundibuliform, up to 15 cm. broad, surface with the texture of chamois, margin cottony-tomentose ..... *L. deceptivus.*

Pileus convex to umbilicate, covered with a nap-like tomentum, 5–12 cm. broad; stem stout ..... *L. vellereus.*

17. Pileus hirsute-pubescent, blue-black when young, then zoned with gray, finally yellowish-brown near margin, 5–15 mm. broad; stem short, glabrous; spores cream ..... *L. Bensleyae.*

Pileus squamulose-tomentose, thin, gray, then brownish-gray azonate; stem tomentose at base, 2.5–6.5 cm. long ..... *L. griseus.*

18. Pileus some shade of red ..... 19.

Pileus some other color ..... 20.

19. Pileus and stem mahogany, shining when moist, umbilicate, expanding, but margin arched, about 4 cm. broad ..... *L. nitidus.*

Pileus fulvous, darker in the center, except umbo fading to pinkish, small, fragile ..... *L. oculatus.*

20. Pileus pale alutaceous, azonate, convex-umbilicate, 6–15 cm. broad, margin involute for some time; stem 2.5–6 cm. high; gills close, pallid ..... *L. pallidus.**

Pileus brown, fading, often umbonate, up to 3 cm. broad, margin striatulate; in marshy places ..... *L. paludinellus.*

21. Pileus glabrous ..... 22.

Pileus pruinose velvety ..... 23.

Pileus rimulose-areolate so as to appear minutely squamulose, brick-red when moist, fading when dry, and surface cracking into minute scale-like areas; gills yellowish, then colored like pileus; milk subwatery; odor and size like *L. camphoratus* ..... *L. rimosellus.*

22. Pileus golden-fulvous or brownish-orange, smooth, convex then plane, or slightly depressed, 5–13 cm. broad, surface sometimes cracking; gills white to yellowish, turning brown where injured; odor strong in drying; stout ..... *L. volemus.*

Pileus dark red-brown; stem same color; gills yellow to brick-red; odor sweet; plants small ..... *L. camphoratus.*

Pileus pale-fulvous; gills pallid; milk mild then bitterish; odor none; plants small ..... *L. subdulcis.*

23. Pileus fuliginous-brown, umbonate, center wrinkled, 4–10 cm. broad; stem same color; gills distant; spores white, globose, echinulate ..... *L. Gerardii.*

Pileus yellowish-tawny or brownish-orange, 5–10 cm. broad; gills distant, white or cream; spores broadly elliptical, nearly smooth; stem solid, glabrous or pruinose, 2.5 cm. or more high ..... *L. distans.**

NEW YORK BOTANICAL GARDEN.

New species of fungi

CHARLES HORTON PECK

Lepiota xylophila

Pileus thin, campanulate or convex, umbonate, minutely squamulose, white or whitish and even on the margin when fresh, becoming brownish with age or in drying, with the umbo darker and the margin widely and distinctly plicate-striate ; lamellae rather narrow, free, denticulate on the edge, minutely pulverulent, whitish, faintly tinged with yellow or greenish-yellow ; stem slender, equal or nearly so, hollow, pale-yellowish or greenish-yellow ; spores elliptic, uniguttulate, 8–12 μ long, 6–7 μ broad.

Pileus 2–4 cm. broad ; stem 2–4 cm. long, 2–4 mm. thick.

On wood of red fir, Douglas fir and redwood. Hawaii. Collected by N. A. Cobb ; communicated by H. von Schrenk.

The species is closely related to *Lepiota cepaestipes* Sow., from which it may be separated by its different colors, its peculiar habitat, the even margin of the fresh pileus, and its stem which is not enlarged at or near the base.

Clitocybe nobilis

Pileus fleshy, convex, sometimes becoming slightly centrally depressed, dry, glabrous, firm, creamy-white becoming buff or brownish with age or in drying, often broadly umbonate and darker in the center, flesh white, taste and odor agreeable ; lamellae thin, close, decurrent, whitish ; stem solid, stuffed, or hollow with a small cavity, tapering upward, somewhat bulbous, glabrous, firm, white or whitish becoming pallid or brownish and striate with age or in drying ; spores elliptic, 7–8 μ long, 4–5 μ broad.

Pileus 7–12 cm. broad ; stem 5–10 cm. long, 6–8 mm. thick.

Solitary or gregarious, in clearings, growing in black vegetable mold or from buried wood or bark. Deer lake, Ontario. August. C. Guillet.

A fine large species of a soft or spongy texture when fresh, but it shrinks much in drying and becomes firm or hard. It apparently belongs to the section *Disciformes*.

• Collybia hirticeps

Pileus thin, submembranous, convex, umbilicate, dry, densely clothed with long tufted or matted appressed mummy-brown hairs, which are often somewhat radiately arranged in the fresh plant, giving a sulcate-striate appearance to the margin of the pileus, margin in the young plant and in the mature dried plant strongly incurved; lamellae moderately close, rounded behind, slightly adnexed or free, persistently white; stem long, tough, equal, stuffed with fibrils, tomentose, colored like or a little paler than the pileus; spores globose or subglobose, 4–5 μ long, 4 μ broad.

Pileus 1.5–2.5 cm. broad; stem 5–7 cm. long, 2–3 mm. thick.

Cespitose; decaying wood or branches in woods. Pigeon lake, Ontario. August, 1905. C. Guillet. — Pennsylvania. D. R. Sumstine. Closely allied to *Collybia zonata* Peck, from which it is at once distinguished by its brown color, the entire absence of zones and the longer coarser hair of the pileus.

· Omphalia serotina

Pileus submembranous, convex, sometimes slightly depressed in the center or subumbilicate, widely striate on the margin when fresh and moist, slightly striate when dry, grayish-brown, grayish-white or subcinereous; lamellae rather broad, subdistant, adnate or slightly decurrent, white; stem slender, hollow, glabrous, slightly villose-tomentose at the base, pallid; spores narrowly elliptic, 8–10 μ long, 4–5 μ broad.

Pileus 1–2 cm. broad; stem 1.5–2.5 cm. long, 1 mm. thick.

Among fallen leaves in woods. Near Boston, Massachusetts. December. Mrs. E. B. Blackford. A small species somewhat ambiguous in character. When a specimen is placed in water it revives as in specimens of *Marasmius*, but its texture is not tough as in that genus. Neither is the pileus as distinctly umbilicate as is usual in species of *Omphalia*. It appears to be closely related to *Omphalia grisea* Fr., from which its smaller size and purer white lamellae will separate it.

· Entoloma murinum

Pileus thin, fragile, conic, convex or nearly plane, umbonate, dry, silky in appearance, glabrous to the touch, grayish-brown or mouse-colored, the thin margin often wavy and split, striate in the dried plant; lamellae thin, close, sinuate, adnate, white becoming pale-pink; stem slender, brittle, equal or slightly tapering up-

ward, straight or flexuous, hollow, white or whitish becoming darker with age; spores angular, uniguttulate, 10–12 μ long, 6–8 μ broad, often with an oblique apiculus at one end.

Pileus 2–3 cm. broad; stem 2–3.5 cm. long, 1.5–2 mm. thick.

Among long grass and sphagnum. Falmouth, Massachusetts. September. S. Davis.

This species is closely related to *Entoloma Peckianum* Burt, from which it is distinguished by its smaller size, more fragile texture, and paler color. The umbo also is darker than the rest of the pileus and the margin in the dried specimens is finely striate.

• Entoloma deminutivum

Pileus thin, fragile, convex becoming nearly plane, umbonate, hygrophanous, chestnut-brown or blackish and striatulate on the margin when young or moist, becoming paler and shining when the moisture has escaped, the small umbo darker than the rest of the pileus, odor farinaceous; lamellae thin, narrow, subclose, slightly adnexed, subventricose, white becoming pink; stem fragile, equal or slightly tapering upward, glabrous, shining, white or whitish; spores angular, uniguttulate, 10–12 μ long, 6–8 μ broad.

Pileus 1.3–3 cm. broad; stem 1.3–3 cm. long, 2 mm. thick.

Low damp black soil under trees. Stow, Massachusetts. October. S. Davis.

A small species distinguished from the preceding by its odor, color and hygrophanous character, and from *Entoloma sericeum* (Bull.) Fr., to which it is related, by its umbonate and darker-colored pileus, its white stem and its larger spores.

• Eccilia unicolor

Pileus thin, submembranous, conic or very convex, becoming expanded, umbilicate, glabrous, silky, shining, hygrophanous, yellowish-brown and striatulate on the margin when moist, becoming paler or brownish-orange in drying; lamellae unequal, thin, narrow, close, arcuate, decurrent, sometimes serrate on the edge, colored like the pileus; stem externally cartilaginous, straight or flexuous, glabrous, shining, stuffed, pruinose at the top, colored like or a little paler than the pileus, with a whitish mycelioid tomentum at the base; spores angular, uniguttulate, 8–12 μ long, 6–8 μ broad.

Pileus 1–2.5 cm. broad; stem 3–6 cm. long, 1–3 mm. thick.

Gravelly soil in waste places. Falmouth, Massachusetts.

July. S. Davis. The umbilicus is darker at the bottom. The marginal striations persist in the dried specimens.

Eccilia Subacus

Pileus thin, submembranous, conic, convex or expanded, broadly depressed, umbilicate or truncate, smooth and shining when fresh, densely pruinose when dry, white; lamellae thin, distant, adnate or slightly decurrent, white becoming pinkish; stem slender, fragile, equal or slightly tapering upward, glabrous, stuffed or hollow, white; spores angular, uniguttulate, 10–12 μ long, 6–8 μ broad.

Pileus 0.6–2.5 cm. broad; stem 2–5 cm. long, 1–2 mm. thick.

Gregarious, growing among grass and bushes. Stow, Massachusetts. September. S. Davis.

This species is very closely related to *Eccilia Acus* Smith, but it differs from that species in the even margin of the pileus, in the adnate or but slightly decurrent lamellae, and in the absence of an umbilicus or in having only and rarely a shallow one. The upper part of the stem is sometimes sprinkled with white granules.

Flammula betulina

Pileus fleshy, convex becoming nearly plane, floccose or fibrillose, roughish, viscid when young, subviscid when old, sometimes slightly appendiculate on the margin, buff-colored, flesh white; lamellae thin, broad, close, ventricose, adnate or decurrent with a tooth, whitish becoming cinnamon-brown; stem fleshy, fragile, equal, fibrous, stuffed, striate at the top, whitish; spores elliptic, 6–8 μ long, 4–5 μ broad.

Pileus 5–12 cm. broad; stem 5–7 cm. long, 6–9 mm. thick.

Decaying wood of white birch. Stow, Massachusetts. October. S. Davis.

In the young plant there is a slight webby veil which sometimes adheres in fragments to the margin of the pileus, but usually it is fugacious. The floccose squamules on the pileus are sometimes concentrically arranged.

Inocybe decipientoides

Pileus rather thin, subconic becoming nearly plane, umbonate, fibrillose, squamulose in the center, grayish or grayish-brown, the umbo brown, flesh white; lamellae adnexed, ventricose, subdistant, whitish becoming brownish-ferruginous, white on the edge; stem

fragile, equal or nearly so, hollow, shining, fibrillose, striate and whitish at the top, brownish below; spores subelliptic, obscurely angular or slightly irregular, 10 μ long, 6 μ broad.

Pileus 2–3 cm. broad; stem about 2.5 cm. long, 2–3 mm. thick.

Grassy places. Boston, Massachusetts. June. S. Davis. The species is closely related to *Inocybe decipiens* Bres., but it differs in the color of the pileus, in the hollow stem and in the smaller spores.

Naucoria sororia

Pileus fleshy, fragile, convex, broadly umbonate, glabrous, lacunose, subviscid, tawny, often with a slightly darker zone near the margin when moist, even, wavy, or slightly lobed on the margin, flesh firm, watery, white, taste and odor farinaceous; lamellae narrow, close, adnate, whitish becoming darker with age and in drying; stem equal or slightly bulbous, flexuous, fragile, striate at the top, stuffed, pale-tawny, white within; spores elliptic, 10–12 μ long, 6–8 μ broad.

Pileus 5–10 cm. broad; stem 4–12 cm. long, 4–8 mm. thick.

Solitary or gregarious; in open grassy places. Falmouth, Massachusetts. July. S. Davis. This species is related to *Naucoria semiorbicularis* (Bull.) Fr., from which it may be distinguished by its lacunose pileus, its farinaceous odor and taste, and its fragile character, and by its stem being striate at the top.

Psathyrella betulina

Pileus thin, submembranous, fragile, conic or convex, sometimes broadly umbonate, glabrous, atomate, hygrophanous, fuscous or dark-brown when moist, paler when dry; lamellae broad, adnate, subdistant, cinereous becoming black, white on the margin; stem fragile, equal, hollow, glabrous, shining, white; spores black, elliptic, 8–10 μ long, 5–6 μ broad.

Pileus 1.2–2.5 cm. broad; stem 2.5–5 cm. long, 1–2 mm. thick.

Decaying branches of white birch. Stow, Massachusetts. September. S. Davis.

Hydnum sulcatipes

Pileus fleshy but thin, convex or nearly plane, glabrous; aculei slender, subulate, sometimes compressed at the base and occasionally confluent, especially near the margin of the pileus, whitish, about 2 mm. long; stem slender, equal, sulcate, the ridges sometimes branched; spores subglobose or broadly elliptic, 7–8 μ long, nearly or quite as broad.

Pileus 2–3 cm. broad; stem 2–3 cm. long, 3–4 mm. thick.

Ground in woods. Blue Mounds, Wisconsin. August. J. J. Neuman.

This species is remarkable for the peculiar character of the stem. This resembles the stems of some species of *Helvella* and by reason of it I have ventured to give an imperfect description of the species. No notes concerning the colors of the fresh plant were furnished by the discoverer.

Clavaria amethystinoides

Clubs 2–4 cm. tall, with few rather short suberect branches, very pale-lilac, becoming drab-gray in drying, the branches often compressed and rugose, more or less pruinose when dry, the tips commonly acute; spores globose, 8 μ in diameter.

Among sphagnum. Stow, Massachusetts. September. S. Davis.

This species is evidently related to *C. amethystina* Bull. and *C. Schäfferi* Sacc. From the former it is separated by its different mode of branching and its globose spores; from the latter, to which it seems more closely allied, by its simple, not cestipose mode of growth, by the acute or mucronate tips of the branches, and by the pruinose character of the branches, which also are often rugose and irregular.

Peckiella hymenioides

Subiculum thin, downy-tomentose, white, overrunning the hymenium of the host plant; perithecia subglobose, partly concealed by the subiculum, pale-amber becoming blackish-brown; asci slender, cylindric, 8-spored, 60–80 μ long, 5–6 μ broad; spores simple, subfusiform, pointed or acute at each end, 12–15 μ long, 4–5 μ broad.

On the hymenium of *Lactarius uvidus* Fr. Newfane, Vermont. August. Miss G. S. Burlingham. This species is very similar in external appearance to *Peckiella hymenii* Peck, but its asci are much shorter, its spores smaller, and its subiculum thinner. The milk of the host plant was still present at the time when the specimens were collected.

Leotia punctipes

Receptacle subglobose, undulate, gyrose, very lustrous, dark-green, 4–8 mm. broad in the dried specimens; stem slender, 1.8

3 cm. long, 1-3 mm. thick, hollow, dotted with minute dark-green points, green but paler than the receptacle; asci cylindric or subclavate; spores oblong, straight or slightly curved, 15–20 μ long, 5–6 μ broad; paraphyses filiform.

Among sphagnum. Stow, Massachusetts. September. S. Davis.

This species is similar to *Leotia chlorocephala* Schw., from which it differs in its gyrose or undulate receptacle, its punctate stem and its habitat. The stem is not pulverulent and the spores rarely show any vacuoles.

Dothiorella aberrans

Perithecia cespitose, few or many in a cluster, rarely single, globose or subglobose, erumpent, black; spores numerous, broadly elliptic or subglobose, hyaline becoming slightly colored with age, 5–8 μ long, 4–5 μ broad.

Dead branches of papaw, *Asimina triloba* (L.) Dunal. Oberlin, Ohio. May. F. O. Grover.

This species differs from *Sphaeropsis Asiminae* E. & E. in its clustered perithecia and smaller spores; and from *Dothiorella Asiminae* in its black perithecia and its larger spores at length becoming slightly colored. In this character it makes an approach toward the genus *Haplosporella*, to which it might with almost equal propriety be referred.

Helicosporium Tiliae

Tufted or by confluence effused and forming olive-brown patches; hyphae erect, septate, often paler at the top, 5–8 μ thick; spores forming one coil, subhyaline, 5- or 6-nucleate, obscurely septate, 8 μ thick, the coil 20–22 μ broad.

Bark of basswood, *Tilia americana* L. Near Emma, Missouri. September. C. H. Demetrio.

Rhinotrichum Sumstinei

Widely diffused, thin, tawny-brown; hyphae creeping or ascending, sparingly branched, yellow when viewed by transmitted light, septate, the ultimate, and sometimes the penultimate article also denticulate, 8–12 μ broad; spores globose, colored like the hyphae, 12–16 μ in diameter.

Dead decorticated wood. Pennsylvania. D. R. Sumstine.

Armillaria ventricosa (Peck)

Lentinus ventricosus Peck, Bull. Torrey Club **23**: 414. 1896.

Pileus fleshy, convex or nearly plane above, glabrous, shining, white, the thin margin involute, flesh white or whitish; lamellae narrow, close, decurrent, sometimes dentate or denticulate on the edge, whitish; stem short, thick, ventricose, solid or sometimes hollow through erosion by insects, abruptly narrowed at the base, annulate, white or whitish; spores 10–12 μ long, 5–6 μ broad.

Pileus 8–15 cm. broad; stem 5–10 cm. long, 1.5–2.5 cm. in the widest part.

Ground. Alabama. December. L. M. Underwood.—District of Columbia. November. T. A. Williams.

Fresh specimens received from the last mentioned locality indicated that this mushroom belongs rather to the genus *Armillaria* than to *Lentinus*.

GEOLOGICAL HALL, ALBANY, NEW YORK.

INDEX TO AMERICAN BOTANICAL LITERATURE
(1906)

The aim of this Index is to include all current botanical literature written by Americans, published in America, or based upon American material; the word America being used in its broadest sense.

Reviews, and papers which relate exclusively to forestry, agriculture, horticulture, manufactured products of vegetable origin, or laboratory methods are not included, and no attempt is made to index the literature of bacteriology. An occasional exception is made in favor of some paper appearing in an American periodical which is devoted wholly to botany. Reprints are not mentioned unless they differ from the original in some important particular. If users of the Index will call the attention of the editor to errors or omissions their kindness will be appreciated.

This Index is reprinted monthly on cards, and furnished in this form to subscribers, at the rate of one cent for each card. Selections of cards are not permitted; each subscriber must take all cards published during the term of his subscription. Correspondence relating to the card-issue should be addressed to the Treasurer of the Torrey Botanical Club.

Ames, O. Descriptions of new species of *Acoridium* from the Philippines. Proc. Biol. Soc. Wash. **19**: 143–153. 25 S 1906.
Eighteen species are described as new.

Ammidown, L. E. *Blumenbachia insignis* a casual plant at Southbridge, Massachusetts. Rhodora **8**: 225,226. 24 D 1906.

Arthur, J. C. The paired seeds of cocklebur. Plant World **9**: 227–232. *f. 39.* [N] 1906.

Bailey, J. W. Vancouver Island bryology, no. 1. Bryologist **9**: 95, 96. 1 N 1906.

Bailey, W. W. Our poisonous plants. Am. Bot. **11**: 57–63. N 1906.

Bailey, W. W. Something about names. Am. Bot. **11**: 81–83. D 1906.

Bartlett, H. H. *Juncus compressus* in the province of Quebec. Rhodora **8**: 233. 24 D 1906.

Bean, W. J. South American beeches. Kew Bull. Misc. Inf. **1906**: 379–381. D 1906.

Berger, A. Neue Aloineen und andere Sukkulenten. Notizbl. Königl. Bot. Gart. Berlin **4**: 246–250. 12 N 1906.
Includes a description of *Agave parrasana* sp. nov., from Mexico.

Bessey, C. E. Objects imbedded in trees. Am. Bot. **11**: 54, 55. N 1906.

Birger, S. Die Vegetation bei Port Stanley auf den Falklandsinseln. Bot. Jahrb. **39**: 275–305. *pl. 1, 2 + f. 1.* 8 Je 1906.

Bissell, C. H. A new station for *Asplenium pinnatifidum.* Rhodora **8**: 230. 24 D 1906.

Blumer, J. C. Wild fruits and shrubs of the Priest River valley. Plant World **9**: 240–246. [N] 1906.

Bradshaw, M. F. Common things. Am. Bot. **11**: 55–57. N 1906.

Brandegee, T. S. New species of Mexican plants collected by Dr. C. A. Purpus. Zoe **5**: 231–241. 15 S 1906.

Descriptions of 25 new species in 24 genera, including the new genera *Talinaria* and *Achaenipodium.*

Brandegee, T. S. Plants of California. Zoe **5**: 227–230. 15 S 1906.

Includes descriptions of new species in *Allium, Saliva, Tetracoccus,* and *Argithamnia.*

Britton, N. L. Recent explorations in Jamaica. Jour. N. Y. Bot. Gard. **7**: 245–250. *f. 43.* N 1906.

Brooks, C. Temperature and toxic action. Bot. Gaz. **42**: 359–375. *f. 1–12.* [30] N 1906.

Brown, N. E. *Xanthosoma cordatum.* Kew Bull. Misc. Inf. **1906**: 7. F 1906.

New species, native of British Guiana.

Burns, G. P. & Hedden, M. E. Conditions influencing regeneration of hypocotyl. Beih. Bot. Centralb. **19**[1]: 383–392. *f. 1–4.* 1906.

Chamberlain, C. J. The ovule and female gametophyte of *Dioon.* Bot. Gaz. **42**: 321–358. *pl. 13–15 + f. 1–9.* [30] N 1906.

Chase, A. Notes on genera of *Paniceae.* I. Proc. Biol. Soc. Wash. **19**: 183–192. 8 D 1906. [Illust.]

Includes *Leptoloma* gen. nov.

Clinton, G. P. *Tilletiaceae.* N. Am. Fl. **7**: 47–72. 4 O 1906.

Clinton, G. P. *Ustilaginaceae.* N. Am. Fl. **7**: 3–45. 4 O 1906.

Clinton, G. P. *Ustilaginales.* N. Am. Fl. **7**: 1. 4 O 1906.

Clute, W. N. Wind-distributed seeds. Am. Bot. **11**: 73–75. D 1906. [Illust.]

Clute, W. N. Winged seeds. Am. Bot. **11**: 49–53. N 1906. [Illust.]

Cook, M. T. The embryogeny of some Cuban *Nymphaeaceae.* Bot. Gaz. **42**: 376–392. *pl. 16–18.* [30] N 1906.

Coppedge, R. W. The effect of light on *Melilotus alba*. Trans. Kan. Acad. Sci. **20**[1]: 97–105. 1906.

DeVries, H. Species and varieties: their origin by mutation. Second edition. i–xviii. 1–847. *portrait.* Chicago, 1906.

Edwards, A. M. The examination of certain infusorial earths or clays for the United States Geological Survey. Nuova Notar. **17**: 102–107. Jl 1906.

Edwards, A. M. The magnesian limestone of New Jersey and the search for *Bacillaria* in it. Nuova Notar. **17**: 174–180. O 1906.

Fedde, F. *Eschscholtziae* generis species novae. II. Repert. Nov. Sp. **3**: 27, 28. 31 Jl 1906; — III. Repert. Nov. Sp. **3**: 75, 76. 20 S 1906; — IV. Repert. Nov. Sp. **3**: 105. 20 O 1906; — V. Repert. Nov. Sp. **3**: 183–185. 15 D 1906.
Includes descriptions of 6 new species.

Fernald, M. L. An alpine variety of *Solidago macrophylla*. Rhodora **8**: 227, 228. 24 D 1906.

Fernald, M. L. *Potamogeton spathaeformis* a probable hybrid in Mystic Pond. Rhodora **8**: 224. 26 N 1906.

Fernald, M. L. Twelve additions to the flora of Rhode Island. Rhodora **8**: 219–222. 26 N 1906.

Fernow, B. E. A survey in the tropics [in the high Sierra Maestra of Cuba]. Forestry Quart. **4**: 239–258. D 1906.

Fernow, B. E. List of trees on the Sierra Maestra [Cuba]. Forestry Quart. **4**: 259–269. D 1906.

Fink, B. Further notes on cladonias. VIII. *Cladonia botrytes*, *Cladonia caespiticia*, and *Cladonia delicata*. Bryologist **9**: 89–91. *pl. 8.* 1 N 1906.

Fink, B. Lichens: their economic rôle. Plant World **9**: 258–265. [D] 1906.

Gager, C. S. Outline study of seeds and seedlings. Plant World **9**: 208–218. [O] 1906.

Gager, C. S. Symbiosis in *Gunnera manicata*. Jour. N. Y. Bot. Gard. **7**: 214–217. *f. 31.* S 1906.

Glatfelter, N. M. Preliminary list of higher fungi collected in the vicinity of St. Louis, Mo., from 1898 to 1905. Trans. Acad. Sci. St. Louis **16**: 33–94. 14 Je 1906.

Greene, E. L. A study of *Rhus glabra*. Proc. Wash. Acad. Sci. **8**: 167–196. 18 D 1906.
Includes descriptions of 24 new species.

Hagen, I. A study of *Tetraplodon australis*. Bryologist **9**: 92–94. 1 N 1906.

Hambleton, J. C. Key to the families of Ohio lichens. Ohio Nat. **7**: 14–16. 12 N 1906.

Harms, H. Eine neue Art der Gattung *Macrolobium* Schreb. (*M. stenosiphon*) aus Columbia. Repert. Nov. Sp. **3**: 51–53. 25 Au 1906.

Harper, R. M. The vegetation of Bald Knob, Elmore County, Alabama. Plant World **9**: 265–269. [D] 1906.

Haynes, C. C. Ten lophozias. Bryologist **9**: 99, 100. *pl. 9*. 1 N 1906.

Heimerl, A. Beiträge zur Kenntnis amerikanischer Nyctaginaceen. Oesterr. Bot. Zeits. **56**: 249–255. Jl 1906; 406–414. O 1906; 424–429. N 1906.

Includes new species in *Mirabilis*, *Boerhaavia* (2), *Bougainvillea*, *Neea* (2), and *Pisonia* (2).

Heller, A. A. Botanical exploration in California, season of 1905 (continued). Muhlenbergia **2**: 105–164. 20 F 1906; 165–176. 1 N 1906.

Includes descriptions of 9 new species in 7 genera, and *Malacolepis* gen. nov.

Heller, A. A. Botanical exploration in California, season of 1906. Muhlenbergia **2**: 177–256. 31 D 1906.

Includes descriptions of 20 new species in 14 genera.

Hemsley, W. B. A new fruit from Uruguay. Kew Bull. Misc. Inf. **1906**: 365, 366. D 1906.

Pouteria suavis sp. nov.

Henshaw, J. W. Mountain wild flowers of America. i–xxi. 1–384. *frontisp. + pl. 1–99*. Boston, 1906.

Hillier, J. M. Colorado rubber. Kew Bull. Misc. Inf. **1906**: 218, 219. Au 1906.

Hitchcock, A. S. Notes on grasses. Rhodora **8**: 205–212. 26 N 1906.

Includes new species in *Panicum* (4) and *Glyceria*.

Lorenz, A. Notes on the mosses of Waterville, New Hampshire. Bryologist **9**: 96, 97. 1 N 1906.

McCleery, E. M. Pubescence and other external peculiarities of Ohio plants. Ohio Nat. **7**: 16, 17. 12 N 1906.

MacDougal, D. T. The delta of the Rio Colorado. Bull. Am. Geog. Soc. **38**: 1–16. *map + f. 1–6*. Ja 1906.

Macoun, J. The cryptogamic flora of Ottawa. Ottawa Nat. **20**: 177–186. 3 D 1906.

Continued from Ottawa Nat. **12**: 100 (1898); not, of course, from **21**: 100, as stated.

Macoun, J. M. Contributions to Canadian botany. XVII. Ottawa Nat. **20**: 135–143. 15 O 1906; — XVIII. Ottawa Nat. **20**: 162–171. 6 N 1906.

Malme, G. O. A. *Xyrides* austro-americanae novae. Repert. Nov. Sp. **3**: 111–113. 20 O 1906.

Descriptions of 3 new species.

Massee, G. Fungi exotici: V. Kew Bull. Misc. Inf. **1906**: 255–258. O 1906.

Includes new species, in *Calonectria* and *Stilbospora*, from Trinidad.

Massee, G. Revision of the genus *Hemileia* Berk. Kew Bull. Misc. Inf. **1906**: 35–42. *pl.* Mr 1906.

Four species are recognized, including *H. americana* sp. nov., from Costa Rica.

Masters, M. T. *Aristolochia* (*Gymnolobus*) *consimilis.* Kew Bull. Misc. Inf. **1906**: 7. F 1906.

New species, native of British Guiana.

Masters, M. T. *Aristolochia* (*Gymnolobus*) *daemoninoxia.* Kew Bull. Misc. Inf. **1906**: 6, 7. F 1906.

New species, native of British Guiana.

Meeker, G. A little experiment in flower-making. Trans. Kan. Acad. Sci. **20**[1]: 188, 189. 1906.

Merrill, E. D. An enumeration of Philippine *Gramineae* with keys to genera and species. Philipp. Jour. Sci. Suppl. **1**: 307–392. 31 D 1906.

Includes descriptions of 5 new species in as many genera.

Mez, C. Additamenta monographica 1906. Repert. Nov. Sp. **3**: 4–15. 31 Jl 1906; 33–45. 25 Au 1906; 66–71. 20 S 1906; 97–104. 20 O 1906.

Including new American species in *Pitcairnia* (6), *Puya* (12), *Hechtia, Deuterocohnia, Dyckia, Tillandsia* (17), *Guzmania, Aniba, Persea* (5), *Ocotea* (7), *Ardisia, Conomorpha* (2), *Cybianthus, Rapanea* (2), and *Clavija.*

Murrill, W. A. Further remarks on a serious chestnut disease. Jour. N. Y. Bot. Gard. **7**: 203–211. *f. 25–30.* S 1906.

Murrill, W. A. A summer in Europe; some foreign botanists and botanical institutions. Jour. N. Y. Bot. Gard. **7**: 221–237. *f. 32–42.* O 1906.

Nelson, A. & Kennedy, P. B. New plants from the Great Basin. Proc. Biol. Soc. Wash. **19**: 155–157. 12 N 1906.

New species in *Sophia, Sphaerostigma, Godetia, Oreocarya,* and *Cryptanthe* (3).

Overton, J. B. The morphology of the ascocarp and spore-formation in the many-spored asci of *Thecotheus Pelletieri.* Bot. Gaz. **42**: 450–492. *pl. 29, 30.* 22 D 1906.

Paris, E. G. Muscinées de la Guiane française (2e article). Rev. Bryol. **33**: 55–58. [Jl] 1906.
Includes new species in *Syrrhopodon*, *Meteorium*, and *Ectropothecium*.

Paris, E. G. Muscinées des Andes de la Nouvelle Grenade. Rev. Bryol. **33**: 102–105. [N] 1906.
Includes new species in *Lepidopilum* and *Rigodium*.

Parsons, H. G. Children's gardens and their value to teachers of botany and nature study. Plant World **9**: 237–239. *f. 38*. [N] 1906.

Pease, A. S. & Moore, A. H. Peculiarities of *Botrychium lanceolatum* in America. Rhodora **8**: 229. 24 D 1906.

Pilger, R. Ein neues *Antiphytum* (*A. Bornmülleri*) aus dem südlichen Brasilien. Repert. Nov. Sp. **3**: 24, 25. 31 Jl 1906.

Preston, H. W. Two editions of Torrey & Gray's Flora of North America. Rhodora **8**: 232, 233. 24 D 1906.

Ramaley, F. The Tokyo botanical garden. Plant World **9**: 251–258. *f. 40–43*. [D] 1906.

Reagan, A. B. Notes on the flora of the Rosebud Indian reservation South Dakota. Trans. Kan. Acad. Sci **20**[1]: 190–196. 1906.
Includes *Prunus Rosebudii* sp. nov.

Renauld, F. Causerie sur les *Harpidia*. Rev. Bryol. **33**: 89–100. [N] 1906.

Robinson, W. J. The filmy ferns (*Hymenophyllaceae*). Plant World **9**: 219–221. *f. 33–37*. [O] 1906.

Rolfe, R. A. New orchids. — Decade 26. Kew Bull. Misc. Inf. **1906**: 30–34. F 1906; — Decade 27. Kew Bull. Misc. Inf. **1906**: 84–88. Ap 1906; — Decade 28. Kew Bull. Misc. Inf. **1906**: 112–117. Je 1906; — Decade 29. Kew Bull. Misc. Inf. **1906**: 375–379. D 1906.
Includes 12 new American species in 11 genera.

Rusby, H. H. Observations in economic botany made at Oscoda, Michigan. Jour. N. Y. Bot. Gard. **7**: 211–213. S 1906.

Saunders, C. F. Edible pine seeds. Am. Bot. **11**: 87, 88. D 1906.

Saunders, C. F. Mountain misery [*Chamaebatia foliolosa*]. Am. Bot. **11**: 53, 54. N 1906.

Sayre, L. E. The botanical features of the new United States Pharmacopoeia. Trans. Kan. Acad. Sci. **20**[1]: 185–187. 1906.

Schaffner, J. H. Nodding of the terminal heads of *Silphium laciniatum*. Ohio Nat. **7**: 39. 13 D 1906.

Schaffner, J. H. A successful mutant of *Verbena* without external isolation. Ohio Nat. **7**: 31–34. 13 D 1906.

Schaffner, M. The embryology of the shepherd's purse. Ohio Nat. **7**: 1–8. *f. 1–38.* 12 N 1906.

Schlechter, R. *Orchidaceae* novae et criticeae. Decas IV. Repert. Nov. Sp. **3**: 15–20. 31 Jl 1906; — Decas V. Repert. Nov. Sp. **3**: 45–51. 25 Au 1906; — Decas VI. Repert. Nov. Sp. **3**: 77–82. 20 S 1906; — Decas VII. Repert. Nov. Sp. **3**: 106–111. 20 O 1906.

Includes 25 new American species in 12 genera; of the genera one, *Pittierella*, is new.

Schneider, C. K. Species varietatesque *Pomacearum* novae. IV. Repert. Nov. Sp. **3**: 177–183. 15 D 1906.

Includes a description of *Amelanchier Jonesiana* sp. nov., from Arizona.

Setchell, W. A. A revision of the genus *Constantinea*. Nuova Notar. **17**: 162–173. O 1906.

Three species are recognized, including *C. subulifera* sp. nov.

Setchell, W. A. The Sierran puffball [*Lycoperdon sculptum*]. Sierra Club Bull. **6**: 39–42. *pl. 13.* Ja 1906.

Shreve, F. The Hope botanical gardens. Plant World **9**: 201–207. *f. 29–32.* [O] 1906.

Sodiro, L. Contribuciones al conocimiento de la flora Ecuatoriana. Monografia III. Tacsonias Ecuatorianas. i, ii. 1–31. *pl. 1–4.* Quito, 1906.

This is a revised edition of a paper published in 1903.

Sprague, T. A. & Hutchinson, R. R. *Gurania Eggersii.* Kew Bull. Misc. Inf. **1906**: 200, 201. Au 1906.

New species, native of Ecuador.

Sprague, T. A. & Hutchinson, R. R. *Gurania phanerosiphon.* Kew Bull. Misc. Inf. **1906**: 201. Au 1906.

New species, native of Ecuador.

Stapf, O. *Cervantesia glabrata.* Kew Bull. Misc. Inf. **1906**: 76. Ap 1906.

New species, native of Ecuador.

Tayler, M. E. The germination of the morning glory. Plant World **9**: 246, 247. [N] 1906.

Taylor, N. Botanical notes on the vegetation of the high Maestra [Cuba]. Forestry Quart. **4**: 270–273. D 1906.

Taylor, N. Collecting in the mountains west of Santiago, Cuba. Jour. N. Y. Bot. Gard. **7**: 256–260. N 1906.

Thellung, A. Die Gattung *Lepidium* (L.) R. Br. Eine monographische Studie. Neue Denks. Allg. Schweiz. Ges. **41**: 1–340. *f. 1–12.* 1906.

Tullsen, H. The probable origin of key-fruits. Plant World **9**: 233–236. [N] 1906.

Underwood, L. M. A report on the condition of the tropical laboratory. Jour. N. Y. Bot. Gard. **7**: 250–255. N 1906.

Wangerin, W. Die Umgrenzung und Gliederung der Familie der *Cornaceae.* Bot. Jahrb. Beibl. 86: 1–88. *f. 1–10.* 14 Au 1906.

Wiegand, K. M. & Foxworthy, F. W. A key to the genera of woody plants in winter, including those with hardy representatives found growing wild or in cultivation within New York State. Second edition. 1–33. Ithaca, N. Y., 1906.

Wright, C. H. *Achatocarpus pubescens.* Kew Bull. Misc. Inf. **1906**: 6. F 1906.

New species, native of Ecuador.

Wright, C. H. *Astragalus brevidentatus.* Kew Bull. Misc. Inf. **1906**: 200. Au 1906.

New species, native of the Galapagos Islands.

Wright, C. H. *Bidens simplicifolia.* Kew Bull. Misc. Inf. **1906**: 5. F 1906.

New species, native of Ecuador.

Wright, C. H. *Euterpe Jenmanii.* Kew Bull. Misc. Inf. **1906**: 203. Au 1906.

New species, native of British Guiana.

Wright, C. H. *Euterpe ventricosa.* Kew Bull. Misc. Inf. **1906**: 203. Au 1906.

New species, native of British Guiana.

Yamanouchi, S. The life-history of *Polysiphonia violacea.* Bot. Gaz. **42**: 401–449. *pl. 19–28.* 22 D 1906.